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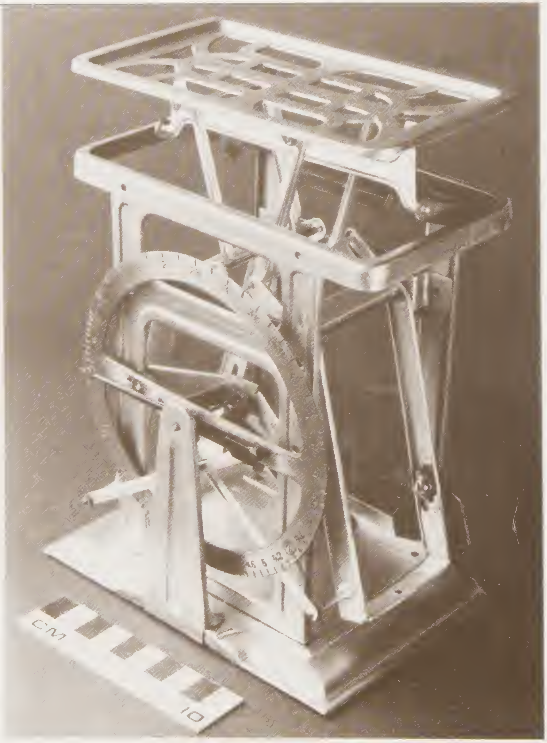
EQUILIBRIUM

QUARTERLY MAGAZINE OF THE INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

SPRING, 1981 M.A. CRAWFORTH, EDITOR PAGES 317-344



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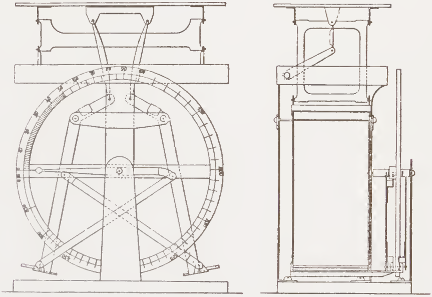
PATENTLY INTERESTING



German patent, No.254082 of 24th October 1911, by Balduin Heller's Söhne, of Teplitz (Bohemia), was for a bilateral pendulum letter balance. The patentees pointed out that the well known bilateral letter scales were only suitable for light loads. Heavy letters and parcels had to be weighed on a conventional beam scale. The reason, they stated, was that a pendulum if designed to weigh heavy loads, had divisions which were too small and unreliable for light letters.

Their patent was for a modified bilateral pendulum where the graduations were on a ring which rotated in the opposite direction to the pointer. Due to this relative motion, the divisions were doubled in size, so that parcels and light letters could be weighed and the divisions read more accurately. (See also, Front Cover).

COVER PICTURE

An intricate bilateral pendulum letter balance made in Germany for the English market. The fascinating action of its mechanism can only be fully appreciated by 'playing' with it, like a kinetic sculpture. Construction is entirely from tinplate and brassplate stampings. Graduated 0 to 16oz x ¼oz, height 220mm (8¾ ins). (See also, Patently Interesting).

INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

Bob Stein, President	20 North Wacker Drive, Chicago, IL 60606 U.S.A.
Michael Crawforth, Vice President	31 Park Lea, Sunderland SR3 3TA England
Robert Miller, Vice President/Treasurer	25W620 Indian Hill Woods Naperville, IL 60540 U.S.A.

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JAPANESE SCALES and WEIGHTS

BY Dr. S.IWATA

It is said that scales (hakari) were introduced into Japan from China, at the end of the sixth century, and that the Chinese systems of metrology were introduced in the late seventh century. Some time after these had been absorbed into their culture, the Japanese improved their weights by changing to a decimal system, which was used from medieval times to the end of the nineteenth century. This system is shown in Table 1. However, the old Weight Standards for official use, which had been based on the Chinese system, continued in use until almost the end of the nineteenth century.

MASS STANDARDS - SYSTEM

KAN	RYO	MOMME	BU	RIN	MO
1	10^2	10^3	10^4	10^5	10^6
	1	10	10^2	10^3	10^4
		1	10	10^2	10^3
			1	10	10^2
				1	10
					1

TABLE 1.

WEIGHTS

Until the end of the nineteenth century, the mean value of weight was 3.73 grams to 1 momme. The weights for balances used for money exchange were in two groups. One group was a set of 1,2,3,4,5 bu, 1,2,3,4,5 momme, and 1,2,3, 4,5,10,20 ryo. The other group was the same as the set above, plus 30 and 50 ryo.

The weights (fundō, or the ancient name hōma) were made of bronze, and were engraved on their surface with the inspector's mark and the maker's crest of the leaf and flower of the Japanese figwort (Paulownia), Fig 1. The Gotô family, weight makers who belonged to the guild of Goldsmiths (Kin-za), were inspectors authorised by the feudal government. They examined user's weights periodically, by comparing them with standard weights.

Weights with a waisted middle and rounded ends were easy to hold and were called the silkworm's cocoon type, Fig 1. The standard deviation of Japanese weights is shown in Table 2. ➢

Dr. Shigeo Iwata lives in Tokyo and is a member of the Comite Internationale pour Metrologie Historique. He is researching the history of scales and weights and has written papers on the development of sensitivity of the precision balance, and standard deviation of weights of the Indus civilisation.

STANDARD DEVIATION OF WEIGHTS (± g)					
NOMINAL VALUE	ST.DEV.	NOMINAL VALUE	ST.DEV.	NOMINAL VALUE	ST.DEV.
1 momme 3.73g	0.0383g	1 ryo 37.3g	0.0674g	10 ryo 373g	0.408g
2 momme 7.46g	0.0415g	2 ryo 74.6g	0.101g	20 ryo 746g	0.894g
3 momme 11.19g	0.0447g	3 ryo 111.9g	0.135g	30 ryo 1119g	1.49g
4 momme 14.92g	0.0479g	4 ryo 149.2g	0.172g	50 ryo 1865g	3.02g
5 momme 18.65g	0.0511g	5 ryo 186.5g	0.208g		

TABLE 2.

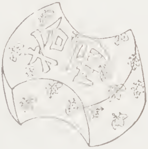


FIG 1. Bronze weight with the marks of the maker and the inspector.

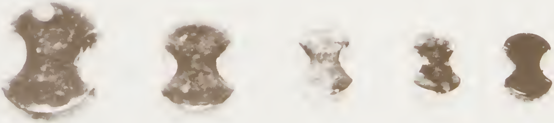


FIG 2. Bronze weights.

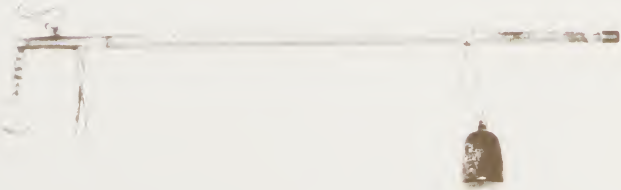


FIG 3. Kagi-bakari. Steelyard with a hook for the load.

STEELYARDS

Since the end of the seventeenth century, the manufacture of steelyards (sao bakari) was carried out by the Jin and Shuzui families, who were responsible for organising their own guilds (hakari-zu). The Jin family had the monopoly for thirty-three western counties of Japan. The head of the Jin family succeeded to the name Zenshirô, and used it from the seventeenth to the eighteenth centuries, so steelyards made by the Jin were given the general name of Zenshirô-bakari, Fig 10.

The Shuzui family had the monopoly for thirty-three eastern counties and their steelyards were called Shuzui-bakari, Fig 9. Both families made steelyards to standard designs which are listed in Tables 3 and 4.

White oak was used for the beams of the large steelyards with a hook for the load (they were called chigi), which were mainly used for weighing bags of rice. Persimmon wood was used to make the beam of the large steelyard with a pan for the load (sara bakari). The tsuno sao bakari had a beam made from horn, or bone of a deer, or from whale bone.

An ivory beam was used for the steelyard (called zogo bakari) which had from two to four fulcra. It had no graduations but had a fixed counterpoise (so it was technically a form of bismar. Ed.). This type was used for checking specific gold and silver coins.

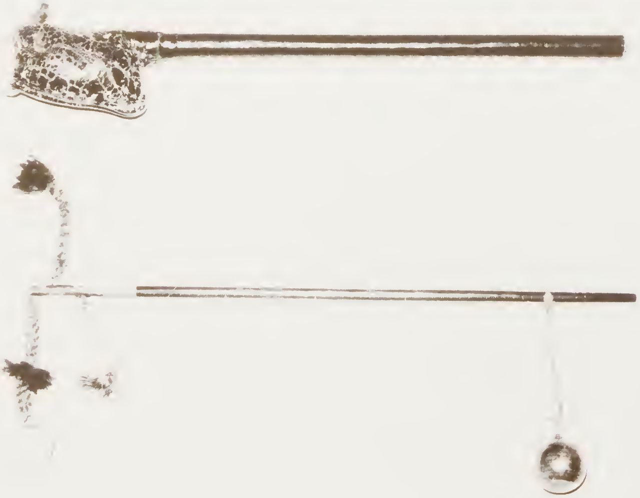


FIG 4. Kagi-bakari. Hook steelyard with a leather scabbard.

JIN					
NAME OF STEELYARD		CAPACITY (in momme)			LENGTH OF BEAM (shaku*)
		UWAME (top)	MAEME (back)	MUKAIME (front)	
	CHIGI (large hook steelyard)	50,000	100,000		10,0
		27,000	56,000		9.0
		26,000	53,000		8.5
		25,000	50,000		8.0
		24,000	48,000		7.5
		19,000	40,000		7.0
		18,000	38,000		6.8
		16,000	32,000		6.5
		15,000	30,000		6.0
		13,000	25,000		5.5
		11,000	23,000		5.0
		8,000	12,000		4.5
		6,000	11,000		4.0
		3,000	6,000		3.3
		1,500	3,500		2.5
		600	2,000		2.0
		250	110	1,000	
SARA BAK. (pan st.)	OHSARA BAKARI (large pan st.)	200	500	1,200	
	NAKASARA BAKARI (mid pan st.)	160	320	1,000	
	KOSARA BAKARI (small pan st.)	50	160	300	
	WATA BAKARI (cotton st.)	250	500	1,200	
GIN TAME (silver steelyard)	TSUNO SAO BAKARI (horn pan st.)	15	50	200	
	KAKI SAO BAKARI (parsimmon beam)	15	50	200	
	TSUGI SAO BAKARI (patched beam)	15	50	200	
	TSUNO GOBU NAGA BAKARI (horn b.)	15	50	200	
	HAKI SAO BAKARI (parsimmon b.)	17	60	200	
	TSUGI SAO BAKARI (patched beam)	17	60	200	
	KOSNO BAKARI (small beam st.)	10	30		
	ICHIRIN TAME (1 rin steelyard)	1.5			
	NI RIN TAME (2 rin steelyard)	5			*1 shaku = 303mm = $11\frac{15}{16}$in
	YAKUSHU BAKARI (drug steelard)	1.5	5		
	HAKI SAO 70 (70 momme st.)	17	70	250	
	ZOGE BAKARI (ivory beam st.)	17	60	200	

TABLE 3.

SHUZUI

NAME OF STEELYARD	CAPACITY (in momme)			MASS BALANCED WITH FIRST SCALE (momme)		ONE SCALE DIVISION (in momme)			MASS OF COUNTER-POISE	LENGTH OF BEAM
	UWAME (top)	MAEME (back)	MOTOME (front)	MAEME (back)	MOTOME (front)	UWAME (top)	MAEME (back)	MOTOME (front)	(momme)	(shaku*)
CHIGI (large hook steelyard)	16,000		32,000	10,000		100		200	2,000	6.5
	12,000		26,000	5,000		100		200	1,500	6.0
	8,000		16,000	5,000		100		200	1,000	5.5
	5,000		11,000	3,000		50		100	700	4.0
	3,000		6,000	1,000		20		100	500	3.0
	1,200		3,500	1,000		10		20	300	2.5
	1,000		2,000	500		10		20	150	2.0
	200		1,000	200		2		10	150	2.0
SARA BAKARI (pan steelyard)	200	500	1,200	100	500	1	2	10	80	1.8
	80	250	500	50	100	1	2	10	60	1.6
	50	160	350	50	100	1	2	10	30	1.2
KAGI BAKARI (hook steelyard)	200	500	1,200	100	500	1	5	10	60	1.4
GIN TAME (silver steelyard)	17	50	160	10	50	0.1	0.2	1	8.5	0.75
	17	50	160	10	50	0.1	0.2	1	11	1.5
RIN TAME (rin steelyard)	1.2		5	1		0.01		0.02	1.4	1.5
	0.6		3	0.5		0.01		0.02	1.0	0.6

* 1 Shaku = 303mm = $11\frac{15}{16}$ inches.

TABLE 4.

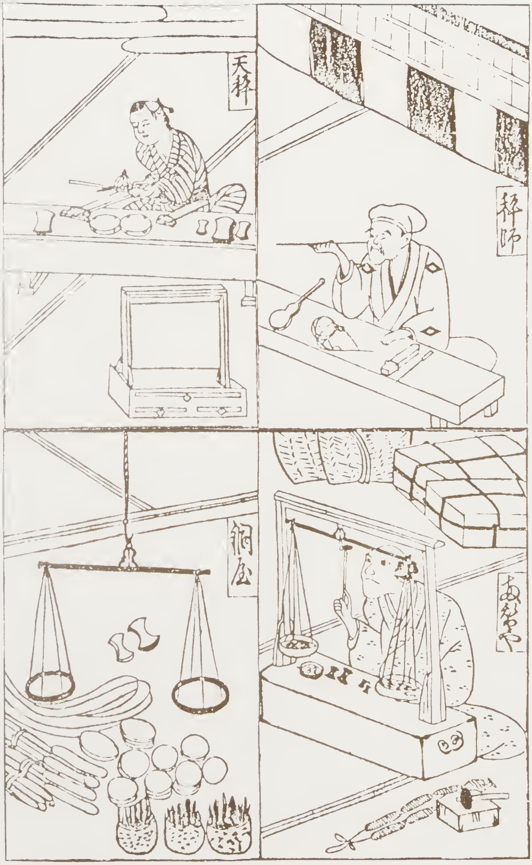
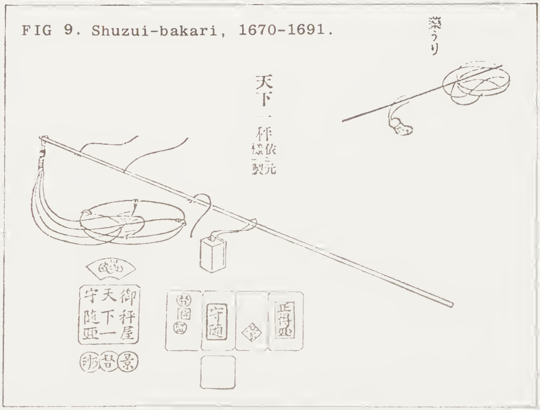

天秤
秤師
銅屋

FIG 9. Shuzui-bakari, 1670-1691.



5	6
7	8

FIG 5. Balance maker filing a beam. Pans and weights are shown on the bench.

FIG 6. Steelyard maker checking that a beam is straight.

FIG 7. Copper worker's equipment showing weights and a scale suspended from the ceiling.

FIG 8. A money-changer tapping his balance to overcome friction in the bearing.

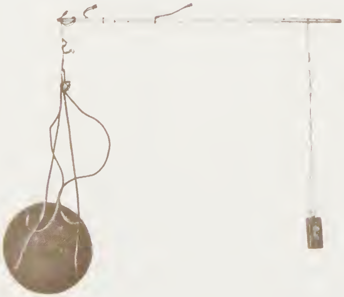


FIG 10. A Zenshiro-bakari. Steelyard made by the Jin family.

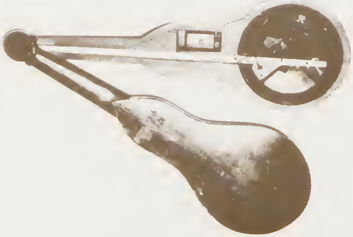


FIG 11. A Shuzui-bakari. Steelyard made by the Shuzui family.

BALANCES

Balance makers did not belong to a guild, so there were no standards for making balances, but users of the scales had to be supplied with weights made by the Gotô family. The most famous of the makers of balances were members of the Nakabori family, who lived in the Western counties of Japan.

Balances (tenbin) were mainly used for the manufacture of gold, silver and copper coins, and for the exchange of money. Money-changer's balances had a maker's mark on the bottom of the drawers in the box. There were four drawers; the top one held the beam, the centre one was for the stand, and the two lower drawers were used to hold the weights.

The beam (sao) with its pointer (mokko) was suspended from the centre of the rectangular wooden stand (tori-i), which was mounted on the top of the box, Fig 12. The length of the beam was about 320 to 360mm (12½ to 14 inches) and the main fulcrum was 20 to 40mm (¾ to 1½ inches) above the centre-line of the beam. Thus, the sensitivity was only about 140 to 200mg. Equilibrium was indicated by the alignment of the broad pointer with the index at the top of the sight hole shears. A central pin was used for the main pivot, and during the final stages of weighing, the friction of the bearing was overcome by tapping the suspension hook of the balance with a small hammer (kozuchi), as illustrated in Fig 8.

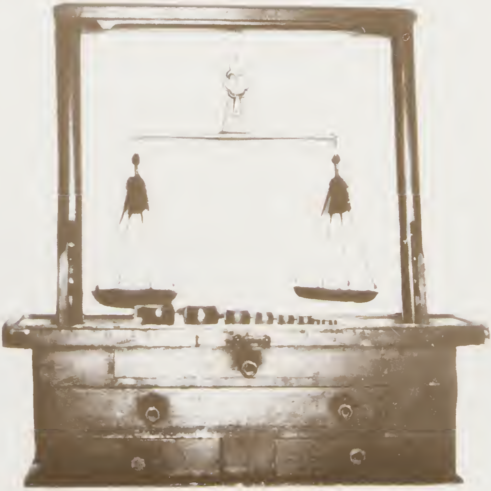


FIG 12. Tenbin. A money-changer's balance.

WEIGHING the WORLD

BY M.JOYCE

What activity could be engaging the attention of a distinguished-looking gentleman and his assistant on the side of Schichallion mountain ? The summit of this Scottish landmark stretches some 1800 feet above them and they look oddly out of place in this bleak area. Inside a hut on the mountain their interest is focussed on a plumb line whose deviation from the true vertical they are measuring with the greatest possible accuracy.

The experiments are being sponsored by The Royal Society of London to find out the pull the large hill exerts on the bob of the plumb line, pulling it very slightly away from the vertical. Schichallion has been chosen because of its unusually uniform shape which will make calculations of its centre of gravity and mass less uncertain. From measurements taken on opposite sides of the mountain the force of attraction between the mass of the mountain and the plumb-bob can be ascertained and a value for the gravitational constant 'G' calculated.

These unusual activities were taking place between 1774 and 1776, with the backing and encouragement of the Astronomer Royal, the Reverend Nevil Maskelyne and the assistance of the Honourable Henry Cavendish, who designed the exact methods to be used in performing the measurements and for calculating the value of 'G' from the results.

At this time, Henry Cavendish was in his early forties and his considerable talents and energies were devoted to scientific work, particularly research concerning the nature of forces between bodies. His comprehension of scientific phenomena was largely inspired by the example of Isaac Newton, whose impact on the understanding of natural philosophy had been enormously influential over the preceding century.

The importance of determining an accurate value for the density of the earth and for 'G' turns on the impossibility of calculating the mass of the Earth and of the planets that make up the solar system, without knowing 'G'. The measurements taken at Schichallion produced a value for the density of the mountain which allowed the mass of the Earth to be calculated. However, the method required too many approximations and the results we now know to have been some eighteen per cent in error. The disadvantage of the plumb line method must have been clear to Henry Cavendish.

He was fortunate in having a close friend who was also a Fellow of the Royal Society and as capable a mathematical and experimental scientist as himself. This man was the Reverend John Michell. Though Michell lived at Thornhill, near Dewsbury in Yorkshire and Cavendish lived with his father in London, they dined together frequently at the Royal Society Club which met at The Crown and Anchor Tavern in The Strand, and at a scientific club which gathered at the Cat and Bagpipes at the corner of Downing Street. They also corresponded regularly and a number of their letters are preserved in the Devonshire Collections held at Chatsworth House.

Both Cavendish and Michell were deeply interested in studying the effects of gravitation and of deducing astronomical principles. Michell, who was seven years older than Cavendish, devised an apparatus for measuring the gravitational constant 'G', and was being encouraged by Cavendish in a letter dated 27th May 1783 to consider that *"if your health does not allow you to go on with that* (a telescope) *I hope it may at least permit the easier and less laborious employment of weighing the World."*

Michell's apparatus had a horizontal rod suspended at its centre by a long, thin wire and carrying at each end a small lead sphere. This rod could swing, or vibrate, in a horizontal plane. A large lead sphere, eight inches in diameter and weighing about 110 pounds, would then be placed at the side of each of the lead balls hanging on the ends of the rod. The attraction between the balls on the rod and the larger eight-inch balls would cause the rod to swing, and an accurate measurement of this deflection would enable the attracting force between the spheres to be calculated. This, in turn, would allow a value for 'G' to be calculated, and provide a figure for the mass of the Earth, from the equation:-

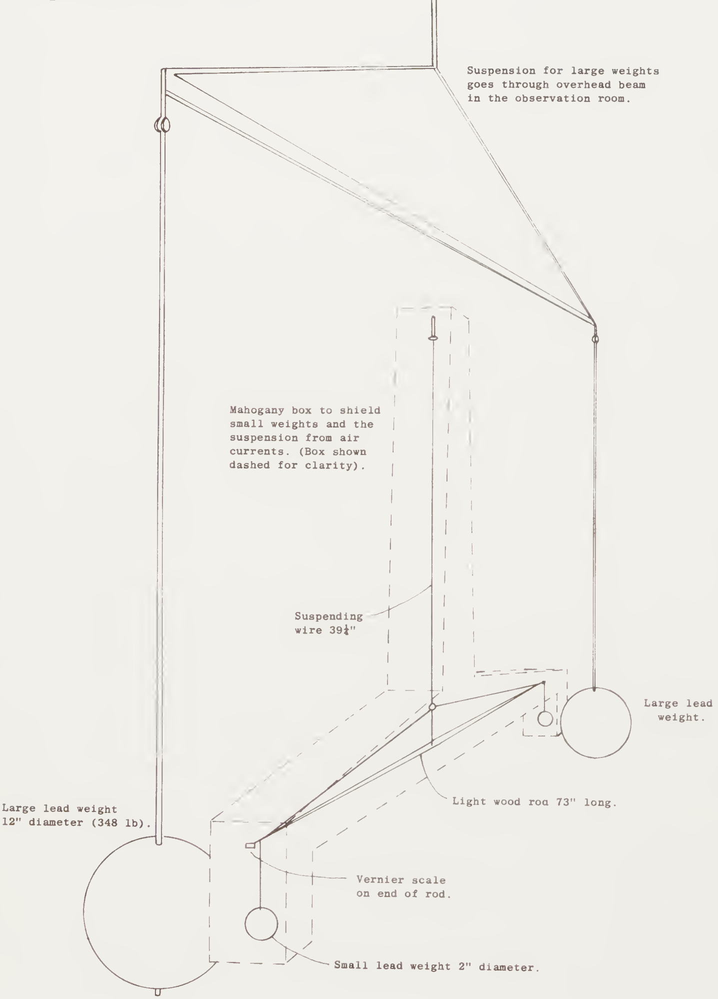
$$\text{Acceleration due to Gravity} = \frac{\text{Mass of the Earth x G}}{(\text{Radius of the Earth})^2}$$

Michell's health gradually deteriorated and he was unable to perform the series of delicate experiments necessary to produce a reliable and accurate value for the gravitational constant. After his death, in 1793, his apparatus for weighing the World passed to the Reverend F.J.H.Wollaston, the Jacksonian Professor at Cambridge, who gave it to Henry Cavendish.

Cavendish inspected the parts and decided to have it reconstructed, incorporating certain changes, and to instal the improved design in his house on Clapham Common, where he set a special room aside for the forthcoming experiments. He decided to observe the movement of the horizontal beam from outside the room, by means of telescopes set through the walls, thereby reducing unwanted effects that a person moving about near the sensitive apparatus would have had. In all his preparations, Henry Cavendish showed himself to be meticulous, prepared to go to enormous painstaking trouble in order to achieve dependable results. Despite this, he and his instrument maker did occasionally get things wrong. For instance, he intended to have the large balls, which he had increased to twelve inches in diameter, come alongside the small two-inch balls in such a position that the attraction between them acted in a direction at right angles to the rod on which the small balls were mounted. Due to an error, the suspension for the large balls was constructed with the separation between the twelve-inch spheres almost three per cent shorter than planned. As a result, the mathematics of the calculations became more complicated and the force of attraction between the large and small balls was reduced by about one-and-a-half per cent below the optimum. However, Henry Cavendish was described as a taciturn and resourceful person and a setback of this kind is not likely to have caused him to remonstrate unduly.

The apparatus consisted of a mahogany box which contained the smaller balls and their supporting rod and wires, as shown in the diagram. The light rod, just over six feet long, carried the balls and a small ivory vernier on each end. Mounted as close as possible to these verniers were fixed ivory scales (not shown in the diagram) with divisions one-twentieth of an inch apart. The vernier allowed the postion of the ends of the rod to be gauged to within one hundredth of an inch. The mahogany box had small glass windows at each end

THE CAVENDISH APPARATUS



Suspension for large weights goes through overhead beam in the observation room.
Mahogany box to shield small weights and the suspension from air currents. (Box shown dashed for clarity).
Suspending wire 39¼"
Large lead weight.
Light wood rod 73" long.
Large lead weight 12" diameter (348 lb).
Vernier scale on end of rod.
Small lead weight 2" diameter.

through which the verniers and scales could be seen using telescopes mounted through the front and back walls of the observation room.

The rod and small balls swung in a horizontal plane about the suspending wire with a time of swing just a little over seven minutes. When the large spheres were brought up close to the box so that they exerted the maximum gravitational pull on the small weights, Cavendish calculated that the force of attraction would not be more than one fifty-millionth of their weights, and that it would be necessary to employ the greatest care in taking measurements, or else the accuracy of the final results would not be an improvement on the Schichallion experiments.

Cavendish later described how he took the readings.*"I observe the two extreme points of a vibration, and also the times at which the arm arrives at two given divisions between these two extremes, taking care, as well as I can guess, that the divisions shall be on different sides of the middle point, and not very far from it. I then compute the middle point of the vibration, and by proportion, find the time at which the arm comes to the middle point. I then, after a number of vibrations, repeat this operation, and divide the interval of time between the coming of the arm to these two middle points, by the number of vibrations which gives the time of one vibration."* He calls the time of vibration 'N'. In an experiment he would commonly be observing vibrations for between three and five hours at a stretch, reversing the large weights periodically from one side of the box to the other.

After each separate experiment Henry Cavendish was able to calculate a value for the force of attraction between the large and small balls. He then worked out that if, on reversing the postions of the large lead balls, the midway point of the swinging arm shifted by 2B scale divisions, the density of the Earth would be equal to:-

$$\frac{N^2}{10683\ B}$$

He published his experimental results in Philosophical Transactions in 1798, when he was 66. The table at the end of his paper listed the Earth's density, calculated from seventeen experiments. The averaged result showed that the Earth was 5.48 times denser than water.

Using the figure he quotes for the mean diameter of the Earth, the weight of the World is 13.1 x 10^{24} pounds, or 5.8 x 10^{21} tons. The modern figure is 13.175 x 10^{24} pounds, and this is more accurate partly because of more refined measurements and also for the reason that the shape of the Earth is not a perfect sphere which Cavendish assumed in making his computation.

Reading Cavendish's own account of the series of experiments leaves no doubt about his care and concern for accuracy. In Philosophical Transactions he gave consideration to whether significant corrections needed to be applied to the results to allow for such effects as the gravitational attraction between the large ball and the distant small weight; for the force between the large balls and the deal rod; for the attraction of the mahogany case on the balls; for the increasing attraction as the small balls swing nearer to the weights. At the start of the experiments he believed that magnetism might be causing some of the variation between different timings he took, and to check this, he detached the large weights and substituted magnets instead, but found this had no measurable pull on the small weights. He then carried out a series of tests to see if temperature differences existed between the weights and the box which might be warming up that part of the box next to the small balls, thereby causing a convected air current to disturb their regular swings. Again, he was able to show that these effects were negligible.

There remains a question about Cavendish which is not easy to explain. Why did a man who conducted his experiments with such precision make some fairly elementary errors ? We have mentioned the first, in having the arm for the large weights too short. Secondly, he miscalculated the effect of this shorter rod, suggesting in his paper that it would affect the calculation by a factor of 0.9779, when the correct figure should be 0.9852. Finally, he gave a column of results from the painstaking observations he had made at Clapham, and yet an arithmetical error when adding up the column was made, with the result that his final figure for the Earth's density is given as 5.48, when the correct arithmetic gives 5.448. By chance, these two latter errors nearly cancelled each other out, and if Henry Cavendish had corrected them both he would still have finished with a weight for the World of 13.1 x 10^{24} pounds.

Over the next century and a half, the experiment was to be repeated by successive generations of scientists, on many occasions. Michell's original apparatus was improved, and even more careful precautions taken than Cavendish believed necessary. However, Henry Cavendish must stand as the most remarkable and significant pioneer in the determination of the weight of the World.

◆ ◆ ◆

NOTES & QUERIES

NQ 48 ASSAY TONS (NQ 42)

When ore containing small quantities of gold or silver has been mined it has to be assayed to determine the proportion of precious metal it contains. For convenience, an amount of ore weighing exactly 29.166g is used for the assay and the brass weight mentioned by John Gerling as '1 UNIT' would be used to weigh out this quantity of ore. At the end of the assay, a gold or silver bead weighing a few milligrams would be left and its weight would be measured accurately using a button balance sensitive to at least 0.01mg.

If the gold or silver button weighs, say 1mg, then there is 1mg of precious metal in every 29.166g of ore. This can easily be translated into the number of troy ounces of gold or silver in an Avoirdupois ton of ore, since there are 29166 troy ounces in one ton.

For richer or poorer ores, fractions or multiples of 29.166g of ore are used for the assay, hence the range of simple multiples of 29.166 in the box of weights.

Reply from M.Joyce.

Assay weights (in German, Probiergewichte) are used to determine the metal content in ores. For precious metals, metric weights are normally used. For silver in North America, the weight of silver grains in milligrams per Troy ounce of ore is used: 1mg per 1oz Troy. 29166oz Troy per short ton.

Reference: Alberti. H.J. 'Mass und Gewicht' Berlin 1957, p365/6.

Reply from R.Rix.

NQ 49 FRENCH POSTAL SCALE

Query from L.A.uit den Boogaard.

I have a postal scale on a glass stand with four brass feet. It is marked N.B. and B$^{\underline{te}}$ SGDG. The abbreviation for Breveté (patented) I know, but what do the other letters mean ? N.B. looks like a maker's initials.

CAN ANYONE HELP LOU UIT DEN BOOGAARD ?

NQ 50 WILLIAM B.PRESTON

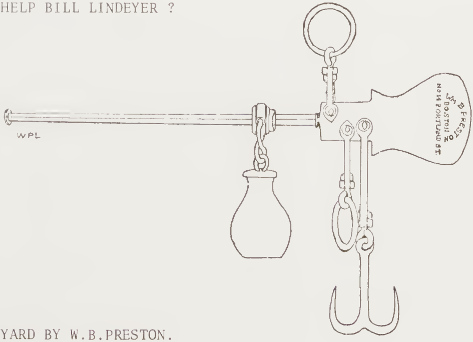
query from W.P.Lindeyer.

I have four brass steelyards made by Wm.B.Preston of Boston, Massachusetts. Although of the same basic design, each varies slightly in length of the beam, in the graduations or in the inscription on the counterweight. On two of the steelyards this reads :-

Wm.B.Preston Boston No.14 Portland st.	W.B.Preston's Patent Feb.22,1870

Does anyone have any information about when these steelyards were made and who William Preston was ?

CAN ANYONE HELP BILL LINDEYER ?



BRASS STEELYARD BY W.B.PRESTON.

MAKING SCALES 1

ILLUSTRATIONS SUPPLIED BY
E.COHN JNR.
COMMENTS BY M.A.CRAWFORTH

The following illustrations are an extract from "*PROGRESS OF THE WORLD - INVENTIONS, ENGINEERING, SCIENCE, MANUFACTURING, INDUSTRIAL DEVELOPMENTS*". published in Chicago and New York, Vol 17. (1915). It appears from Plate 3 that the scales were being made in the works of John Chatillon & Sons, of New York.

PLATE 1. FIRST STAGES OF BEAM CONSTRUCTION

The long lever was used to raise the steelyard beam for calibration, and a large frame carried the load. A special test weight with a sharp edge inside the hook was placed on the beam and moved along to the point of balance. When the beam was in equilibrium, a light tap with a hammer marked the spot where a notch was later cut. The apprentice appears to be drilling the bearing holes in a suspension shackle. A pile of beams was lying on the floor awaiting attention.

PLATE 2. EXPERT DECORATORS APPLY STRIPING

The skilled decorator painted regular straight lines without the aid of a rule or mahl stick. The balances shown are the type with a removable top pan, commonly used for weighing in the kitchen. The same style could also be used for baby scales, see Plate 5.

PLATE 3. TESTING SCALES FOR USE IN MEAT MARKETS

Test weights were placed in the galvanised iron meat tray, and any adjustments could be made to the spring balance. The name John Chatillon & Sons can just be discerned on the face of the dial.

PLATE 4. PRELIMINARY ADJUSTMENT OF WAREHOUSE SCALES

A large collar on the shank of the hook assisted in gripping when the test weights were lifted. It also protected the man's hand from being cut by the sharp inner edge of the hook.

PLATE 5. ADJUSTING AND TESTING BABY SCALES

Apparently, the workman was adjusting the balance for the weight of the wicker basket. Note the very large flat stacking weights.

In the introduction to the series of illustrations, the reader is informed that in the modern scale factory "*he may find in course of construction everything from delicate Torsion balances of the chemist to the immense scales required in big warehouses, and platform scales such as are used for weighing heavy loads of coal and other merchandise, load, wagon horses and all*".

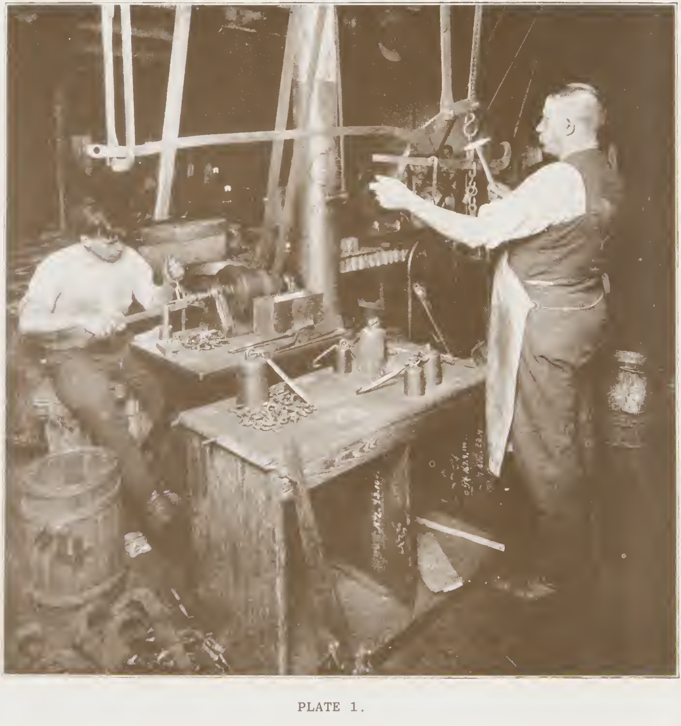


PLATE 1.

PLATE 2.

PLATE 3.

PLATE 4.

PLATE 5.

GLOSSARY OF TERMS CONTINUED

TAPE - see BAND

TARE BAR - a bar parallel to the beam of a scale, and which carries a tare poise*. Also called a SIDE BEAM (USA).

TARE POISE - a weight used to balance an empty container before it is filled with a load for weighing, so that only the load is weighed.

TARE WEIGHT - the weight of a container or wrapper used to hold goods whilst they are weighed. TARE WEIGHT = GROSS WEIGHT - NETT WEIGHT.

TASSEL - a bundle of fibres, usually silk, attached to the suspension ring of small scale, and the means by which the scale can be conveniently held in the hand, Fig 13. Tassels were also used for decoration at the top of the pan cords, Fig 35.

TELESCOPE WEIGHTS - see STACKING WEIGHTS.

TELESCOPIC STEELYARD - a steelyard with an extending telescopic beam. The extending section of the beam is the weight, so that the degree of extension indicates the weight, Fig 72. See also, SLIDING BEAM STEELYARD.

TENSION SPRING BALANCE - a scale with a spring which is stretched in operation. It is the most common form of resistant* in spring balances. See also, COMPRESSION SPRING SCALE.

TORSION BALANCE - (1) a scale constructed with tensioned steel bands instead of knife edges or other bearings. Pivotting is achieved by the torsional twisting of the band, Fig 69.

(2) a sensitive balance using the torsion (twisting) of a fine filament for the resistant*.

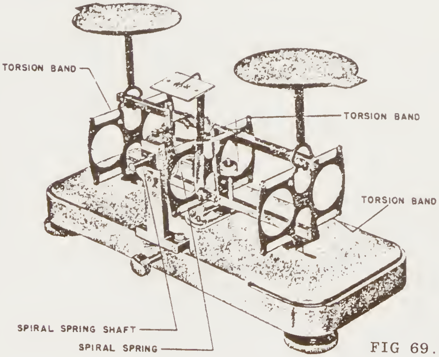


FIG 69. TORSION BALANCE

TRANSPOSITION WEIGHING - the load is first weighed in one scale pan and then in the other pan. The true weight is then calculated as the square root of the product of the two weights obtained. TRUE WEIGHT = $\sqrt{W_1 \times W_2}$ Also called GAUSSIAN WEIGHING.

TRIG LOOP - see TUMBLER

TRIP SCALE - a vibrating* counter scale (USA).

TRUMPET END - an ancient Egyptian beam-end shaped like the bell of a trumpet, and using a cord pivot, Fig 39 No 1. The shape was revived during the Renaissance, but with a rudimentary knife edge and ring similar to a swan neck end. Also called a LOTUS END.

TRUTH - a scale is said to have truth when the beam at rest is horizontal, both when unladen and when equal masses are placed in the pans.

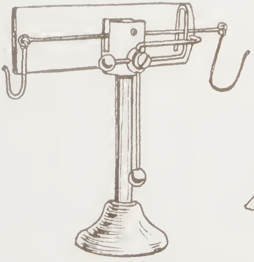


FIG 70 YARN BALANCE Ht.50mm

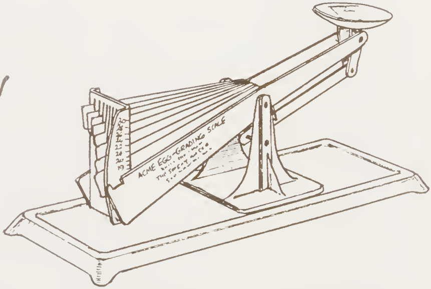


FIG 71 WEIGHT-LIFTING EGG BALANCE

TUMBLER - a hinged catch used to immobilise or lock a scale beam, or a steelyard blade, when not in use, so preventing wear, Fig 14. Also called a TRIG LOOP (USA). See also, LOCKING GEAR.

TURN - a poise hinged at one end so that it can be turned to two weighing positions on the beam. It is typically used on folding gold balances*, Fig 30. and on some English bread scales.

TURN-OVER STEELYARD - a steelyard having two (or more) suspension points and one load pivot, providing two ranges of capacity, one for light loads and one for heavier loads. The instrument is turned over to use the alternative suspension shackle* and to display the other graduations. Also called a REVERSIBLE STEELYARD.

** An explanation of the term marked * appears in the Glossary*

TWO-KNIFE BALANCE - see SUBSTITUTION BALANCE

ULTRA-MICRO BALANCE - see PRECISION BALANCE

UNDER-AND-OVER SCALE - a trade scale with only a zero line marked on the chart*, (USA).

UNEQUAL-ARM BEAM - a scale beam in which the load pivot and weight pivot are located at different distances from the fulcrum, to take advantage of the leverage so obtained. A common example is the steelyard*.

UNSTABLE WEIGHBEAM - see ACCELERATING BEAM

VERIFICATION MARK - a mark or stamp used by inspectors of weights and measures to certify that scales or weights comply with regulations and are accurate. The stamp is punched or hammered into the metal surface. Also called an APPROVAL SEAL (USA).

VIBRATING BEAM - a scale beam which rocks up and down before reaching equilibrium in a horizontal position. See also ACCELERATING BEAM.

V SPRING BALANCE - a balance which uses a spring in the form of a letter V, Fig 73. The suspension loop and load hook are attached to the ends of the vee. Also called a SECTOR SPRING BALANCE.

WATER WEIGHTS - see HYDROSTATICAL SCALES

WEIGHBEAM - see BEAM

WEIGHBRIDGE - a large type of platform scale* used to weigh road vehicles, railway trucks, barges etc.

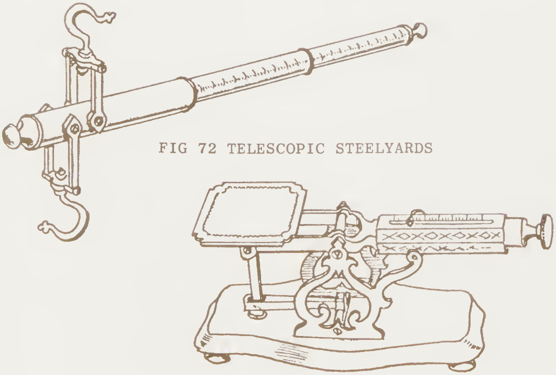


FIG 72 TELESCOPIC STEELYARDS

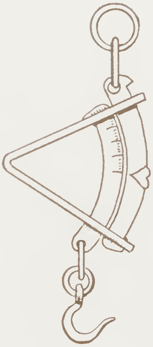


FIG 73 VEE SPRING BALANCE

WEIGHING - the comparison of an unknown mass with a known mass. This is true even for self-indicating scales, such as spring balances, or pendulum balances, which are calibrated with reference to a known mass or masses.

WEIGHMASTER'S BEAM - a steelyard, especially if used officially for verification, (USA).

WEIGHT - (1) the force arising from gravity when it acts upon the mass of a body.

- (2) a suitably shaped piece of material the mass of which conforms to a recognised system of units. In modern terminology the term MASS is replacing WEIGHT.

Many materials have been used to make weights, e.g. lead, stone, brass, bronze, copper, aluminium, iron, and other metals, glass, earthenware, seeds, etc,etc. There are many traditional forms of weight, which fall into three major categories; Geometric, Figurative and Symbolic. Some of the more common ones are shown in Fig 74. See also POISE, COUNTERPOISE, CHAIN BALANCE, RIDER, PROPORTIONAL WEIGHTS, WIRE WEIGHTS, WATER WEIGHTS, TARE POISE, CURRENT WEIGHT, FRACTION WEIGHTS, GROSS WEIGHT, NETT WEIGHT.

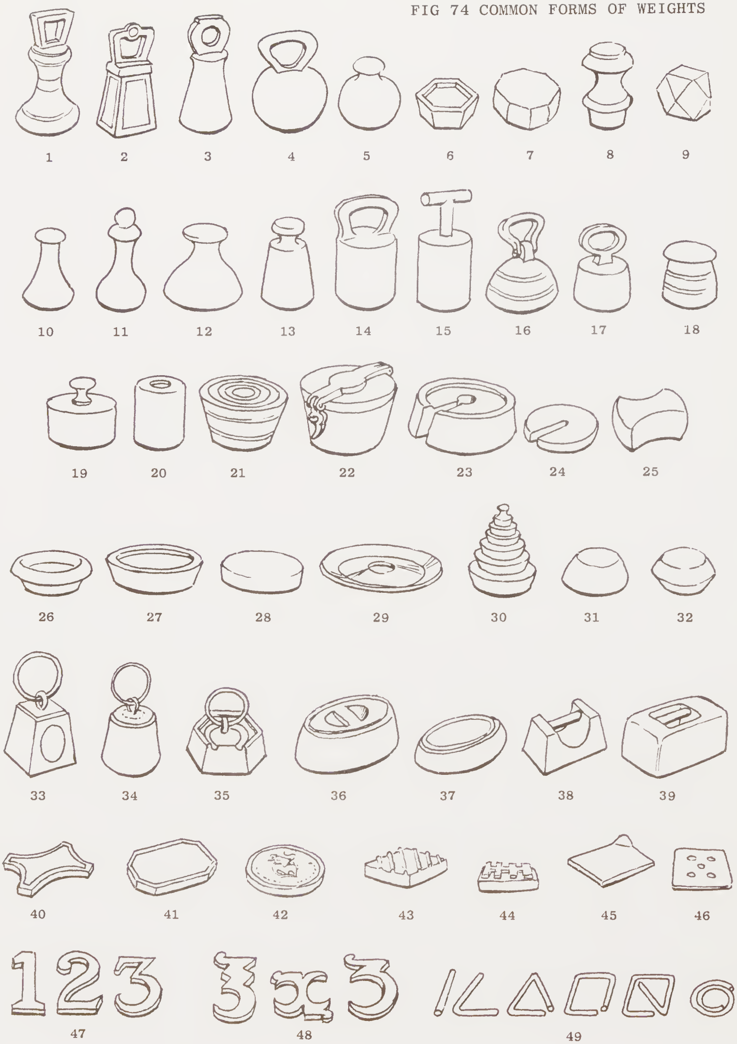
KEY TO FIG 74.

1,2,3	Bell wts. (2 = square bell)	36,37	Oval wts.
4,5	Globe wts.	38,39	Bar wts.
6	Hexagonal wt.	40	Concave wt.
7	Octagonal wt.	41	Lozenge wt.
8	Victoria wt. from brass stand.	42	Coin-form (Monetiform)
9	Polygon wt.	43,44	Geometric wts.
10,11,12,13	Bottle wts.	45,46	Sheet wts.
14,15,16,17	Handle wts. (16 hinged)	47	Numerical wts.
18	Mushroom	48	Symbol wts.
19,20	Cylindrical wts.	49	Wire wts (coded shape)
21,22	Nesting wts (22 lidded)	50	Cube wt.
23,24	Slotted wts.	51	Square wt.
25	Violin wt.	52	Rectangular wt.
26	Convex wt.	53,54,55	Square tapered wts.
27,28	Flat round wts.	56	Round tapered (raised rim)
29	Flat ring wt.	57	Round tapered (flanged)
30	Stacking wts.	58,59	Round tapered (knobbed)
31	Cupcake wt.	60,61	Animal-form (Zoomorphic)
32	Double cone wt,	62,63	Human-form (Anthropomorphic)
33,34,35	Ring wts.	64,65	Plant-form wts.

Several of the above terms may apply to one weight, e.g. No. 36 is an Oval bar weight. No. 57 is Round, tapered, knobbed and flanged. The term 'tapered' is considered easier to use than the more correct 'inverted truncated cone'.

** An explanation of the term marked * appears in the Glossary*

FIG 74 COMMON FORMS OF WEIGHTS



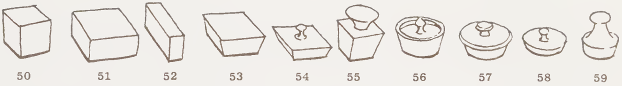
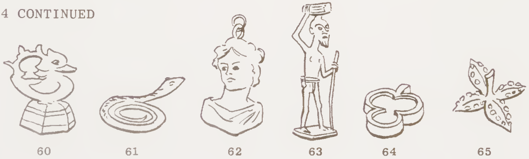


FIG 74 CONTINUED



WEIGHT BOX - a receptacle for weights when they are not in use. See also WEIGHT RACK.

WEIGHT LIFTING SCALES, WEIGHT COLLECTING BEAM - a scale with a beam which collects weights automatically as it tilts, until sufficient have been collected to balance the load, Fig 71.

WEIGHT PAN, WEIGHT PLATE - the receptacle on which weights are placed for weighing, Fig 58. Also called a WEIGHT PLATTER (USA). A pan is concave, and a plate is flat. See also GOODS PAN.

WEIGHT PLATTER - see WEIGHT PAN

WEIGHT PROVER - an instrument which proves whether an object is the correct weight, or not. If the object is not the correct weight, the instrument has no means of determining the actual weight. An example is the common English sovereign rocker, Fig 54.

WEIGHT RACK - a rack or bar for storing slotted weights* when they are not in use, Fig 14. See also WEIGHT BOX.

WIRE WEIGHTS - weights made of wire and used for precision balances. The weights are shaped to indicate the denomination, the number of sides being equal to the number of units, Fig 74 No 49.

YARDAGE SCALE - see YARN BALANCE

YARN BALANCE - a scale used to determine the characteristics of yarns and cloths, usually by weighing small samples. Various designs are used, but one type is shown in Fig 70. Also called a YARDAGE SCALE (USA).

ZERO ADJUSTER - the means of adjusting a weighing device to an accurate zero reading when unloaded.

** An explanation of the term marked * appears in the Glossary*

ISASC

EQUILIBRIUM

QUARTERLY MAGAZINE OF THE INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

SUMMER, 1981 M.A. CRAWFORTH, EDITOR PAGES 345-372

Editor's Comment

Showcase

I feel sure there are many members who would like to contribute to our magazine, but who believe they have nothing to write about which would be of interest (only a few of us are engaged in active research). Yet, everyone who has scales and weights has something to offer. Before you tell yourself that this does not apply to you, let me explain the new feature which starts in this issue.

Showcase will be a regular page of pictures sent in by members. All you have to do is send me a photograph of a scale you like in your collection (it does NOT have to be rare or exotic), and include some brief notes about it. Just describe it as you see it in front of you - dimensions, maker's marks (if any) denomination of weights or graduations, and the purpose, if you know it.

Send me the 35mm black-and-white negative or a good clear black and white print about 60 x 90mm (2½ x 3½ins). If you would like some help in taking good photographs, the article on page 363 gives lots of practical hints. If you really can't take them yourself, surely you can find a friend who can !

Cover Picture

Yes, this exotic confection IS a scale! The snake along the top is the beam which pivots about the centre. A frame, now missing, was suspended from his tail and held a letter to be weighed. One of the bell-flower weights was then removed from its storage hook and hung on the snake's tongue, as required. The weights were 4,2 and 1oz on the hooks, and, on the evidence of another example seen, there was also a ½oz weight stored on the tongue. All parts were made of brass and look superb in their rich matt gilding. The elegantly engraved base has a crowned S in the centre, probably the monogram of the original, titled (?), owner. Inclusion of a ½oz weight suggests that the scale was made during the period 1840 - 1871, but this is not conclusive evidence

INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

Bob Stein, President — 20 North Wacker Drive, Chicago, IL 60606 U.S.A.
Michael Crawforth, Vice President — 31 Park Lea, Sunderland SR3 3TA England
Robert Miller, Vice President/Treasurer — 25W620 Indian Hill Woods
Naperville, IL 60540 U.S.A.

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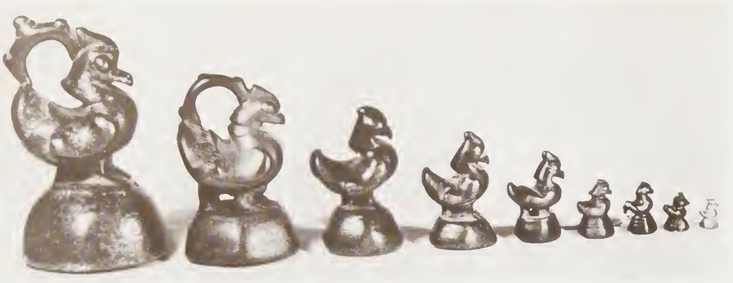

Burmese Bronze Weights

GERARD HOUBEN

Of the many small bronze objects in animal form which come from South East Asia, only a few types are real weights. The most well-known are the birds and the lions. The name of the mythical bird is 'HENTHA' and there is a special association of the hentha with Pegu, the capital of Lower Burma. The hentha is revered by Buddhists because the first Lord Buddha was a hentha in a previous existence, and was king of the birds. The nicely decorated 'CHINTHE'is a mythical lion which appears to have been confined to guarding pagodas. A later type of lion is called'TO'(or TONYA), and it symbolises the power of the king and is less modest and more active in attitude. Originally, the chinthe was associated with Northern Burma. However, during the centuries of changing dominance from North to South, and back, both animals became popular in the whole region, including part of Siam, Assam and the Shan States.

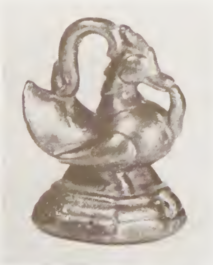

FIG 2. A 50 kyat Hentha of Group 3, made c1725.

Because the Burmese kings retained absolute power they had strict control over all trade and, as a consequence, also over the weights. Both the style of the weights and the signs appearing on the base guaranteed that they had been officially approved and were reliable. They were used for foreign trade, for all currency transactions, they were used by tax collectors and by gold and silversmiths. There is no historical justification for the popular name "opium-weights".

All old Burmese weights are made of bronze. This alloy is harder than copper and is more corrosion-resistant, but it is more expensive, due to the tin content of the alloy. The composition varied somewhat with the availability of ore from the occupied territories. In consequence, the colour of the patina varies.

FIG 1 (TOP). A series of Hentha weights, 100 to ¼ kyat, Group 2a

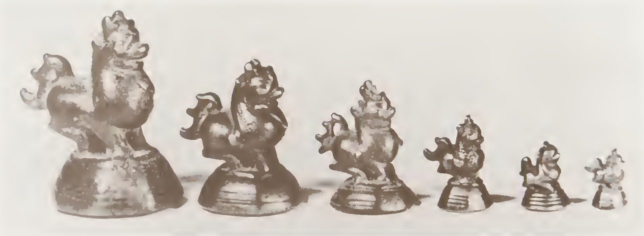

FIG 3. A series of Chinthe weights, 20 to ½ Kyat, Group 2b.

The bronze weights were made by the lost-wax process (cire - perdue), a new wax form being made for every weight. This explains the many small differences in detail between the various weights.

Although the binary and duodecimal systems were in use all over the world, the decimal system has been in use in China, India and adjacent countries from about 500BC. A decimal system was used for Burmese weights and their mass was expressed in KYATS. The largest series of animal weights comprises weights of 1/8,1/4,1/2,1,2,5,10,20,50,100 and 250 kyat. Weights of 50 kyat and heavier occur only in Groups 2 and 3.(These Groups are discussed later). From the examination of over a thousand weights, it appears that nearly half of them were of 20 kyat (roughly 320 gm or 11 oz A.)[5]. Such a weight has a height of about 70mm (2¾ins). Two-thirds of the weights were birds, the others were lions.

In 1885, when the whole of Burma was occupied by the British, the old empire ended and with it, its weight system. From then on, the English system, which was more old-fashioned, became official.

It is evident that several Burmese weights, which had been in use over a period of many decades, have lost part of their mass. A few have been adjusted with lead between the legs, but later on they were again exposed to wear and tear. On some other weights the handle has been broken off, and their mass

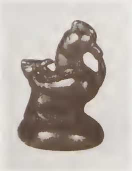

FIG 4. A 10 Kyat Hentha of Group 5.

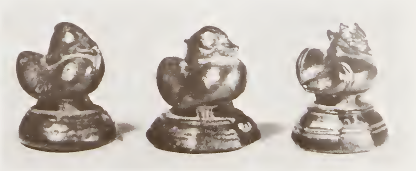

FIG 5. Three 10 Kyat Henthas of Group 4.

HENTHA (MYTHICAL BIRD)	GROUP						
	5 c1550	4b c1600	4a c1700	3 c1775	2b c1800	2a c1800	1 c1850
TAIL-FORM	DOWNWARDS	U	U	V	U or V	U or V	U or V
TAIL COVER	-	-	-	OGIVAL	OGIVAL	ARCHED	STRAIGHT
BASE	OCTA-ROUND	ROUND	OCTAGONAL	OCTAGONAL	OCTAGONAL	HEXAGONAL	HEXAGONAL
CHEST	PLAIN	PLAIN	PLAIN	PLAIN	PLAIN	PLAIN	SOME DECORATED
STAMP - right front	-	6-STAR	6-STAR	9-STAR	BIRD	6-STAR	BIRD or 6-STAR
- front	-	CIRCLE	CIRCLE	CIRCLE	-	-	-
HEAD-KNOBS	CREST	1 to 3	1 to 3	3	3	1	1 to 3
MANES	-	SOME 1	SOME 1	2 to 4	2 or 3	1 to 3	1 or 2
APPEARANCE	BROODING	SQUATTING	SQUATTING	APPENDAGE BEAK TO CHEST	SLIM	STURDY	MORE DETAIL & DECORATION
MASS OF 1 KYAT	14.0g	14.5g	15.2g	15.6g	16.5g	16.5g	16.57g

CHINTHE, TÔ or TÔNYA (MYTHICAL LIONS)	GROUP				
	5 c1550	4 c1700	2c c1785	2b c1785	2a c1800
TAIL-FORM	LOTUS BUD	(NO TAIL)	HORSE-TAIL	HORSE-TAIL	HORSE-TAIL
BASE	OCTAGONAL or ROUND	OCTAGONAL	OCTAGONAL	OCTAGONAL	SQUARE
CHEST	DECORATED	SOME DECORATED	PLAIN	DECORATED	PLAIN
STAMP - right front	-	6-STAR	4-STAR	9-STAR	9-STAR
- front	SQUARE	CIRCLE or SQUARE	-	-	-
HEAD-KNOBS	0 or 1	0	2	1	1
MANES	0 to 4	0	2	0	2
TAIL-KNOBS	0	0	2	3	2
TOES	0	0	1	1	5
BEARD	-	ON SOME	OPEN TREFOIL	V	BEARD-LIKE ROD
APPEARANCE	SITTING	CROUCHING	STANDING	STANDING	STANDING
MASS OF 1 KYAT	14.0g	15.0g	16.5g	16.5g	16.5g

4-star, 6-star, 9-star indicates the number of points on the star.

also has often been adjusted with lead. In spite of this wear, the classification of over a thousand weights, mainly based on style-groups, indicates that the mass of the kyat, which was 16.57 grams in 1885, had been lighter in earlier periods.

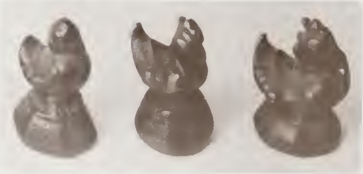

FIG 6. Henthas of Groups 2a, 2b & 3.

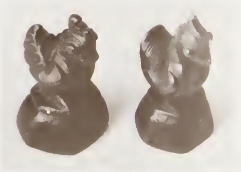

FIG 7. Henthas of Groups 1a & 1b.

When studying a collection of animal weights, it is possible to distinguish not only differences in design, but also a sequence in the development of styles. The discrete steps in these changes seem to be related to the start of a new period of government, or to a change in mass. The small weights are difficult to classify because they are simplified in design, but from 5 kyat upwards the design is consistent in each Group. Weights larger than 20 kyat often have extra decoration and are more elaborate, Fig 2. The many variations are related to :-

1. The base: high or low, square, hexagonal, octagonal, round, or a form of rounded-octagon.
2. The sign and its location on the base: on the right front side - a four, six or nine-pointed star; a bird looking to the left, or to the right: On the front - a small square, a circle or an arrowhead. A combination of two or more signs is also found.
3. The animal standing, squatting or even in a brooding position. The chinthe may be seated, but the tó is always standing.
4. The type of appendage on the beak of the hentha, or the form of beard on the chinthe and tô.
5. The form of the tail: a hentha has a U or V-form tail with, or without, one or two tail covers; these could be straight at the end, arched, or ogival. The underside is always hollow, except for Group 4. Differences can also be seen in the tail of the chinthe and tó.
6. All chinthes and tô have two horns and two ears on the head; in addition the tós could have one or two central head knobs. Henthas have one, two or three head-knobs.
7. All animals could have neck-manes, one, two or three with, or without side decoration. Some have no mane.
8. Handles, which occur only in a few Groups: they are present on weights of 50 kyat and larger, but on the latest sub-group of tós they occur from 10 kyat upwards.

9. The wings: on the oldest Group they are concave. In the 17th century they became convex, for easier handling.
10. The henthas with a tail in U-form are short and stout, those with a V-tail especially in Group 2b, are distinctly elongated and slender.
11. Many more details: legs, eyes, indications of feathers, type of wings, shape of the head, decoration of the breast, manes and tail side, etc, could be used for classification into groups and sub-groups, but this would be too detailed for the purpose of this article.

The bird-weights can be divided into five date groups and the lion-weights into three. Their main characteristics are shown in the tables on page 349. A few weights from transitional periods have been omitted. From the tables, it is obvious that differentiation between the Groups is based on mass, as well as other features. This is only possible if the deviation from the original mass is not too great. The general form of the weight is normally sufficient for classification. Signs on the base are also reasonably important.

D.Gear indicates, in his unpublished works, that the hentha was known in Lower Burma, and the chinthe in Central Burma, before 1550. King Tabinshwahti conquered Lower Burma in 1540, but made the southern city, Pegu, capital of the country. He made the first attempt to bring uniformity into the weight system (the oldest class of Group 4 henthas with concave wings). King Bayinnaung (1551-1581) combined Burma with the Shan States, Northern Thailand and part of Laos. He standardised the weights and measures system, but kept the hentha for the South and the chinthe for the rest of Burma. However, the mass and several details were made similar (Group 4.). These weights were in use for a very long period, and many were adjusted for wear. Of all the weights examined in 1972, about 10% appeared to be birds of Group 4 and the quantity of chinthes was even higher. One Group 4 hentha was discovered with the date 1101 (Buddhist era, equivalent to 1739 AD).

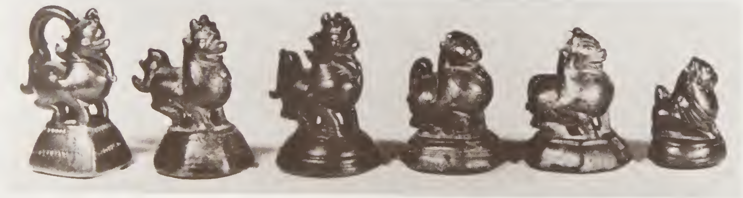

FIG 8. Chinthes of 20 Kyat, Groups 2a,2b,2c,4 and 5.

Group 3 is a small number of henthas which are distinctly different from the others. They are said to be related to the short period of independence of Pegu, between 1740 and 1777. The powerful king Bodowpaya (1782-1819) re-conquered all the lost territories, and added Assam and the South-West regions. First, he introduced a new mass, with weights of a different design. Then, around 1800, he ended the use of an octagonal base and changed from the mythical chinthe to the to, as a symbol of power. In the survey of 1972, about half of the weights examined were henthas of Group 2, and nearly 20% were chinthes of Group 2.

Chinthes have not been made since the annexation of Burma's territories by the British, in 1826, but a small number of beautiful henthas, of excellent quality, were made, Group 1. The high quality may have been due to the availability of better metals and equipment.

Before concluding, it is necessary to mention the unofficial weights. They comprise :-

a) Various animal forms, usually of too incorrect a mass to be used as genuine weights.

b) New bird shapes (including the peacock, Fig 9.), which are quasi-old; often ugly reproductions of henthas in Group 2; and chinthes of incorrect mass. These are all made for the tourist trade and are not proper weights.

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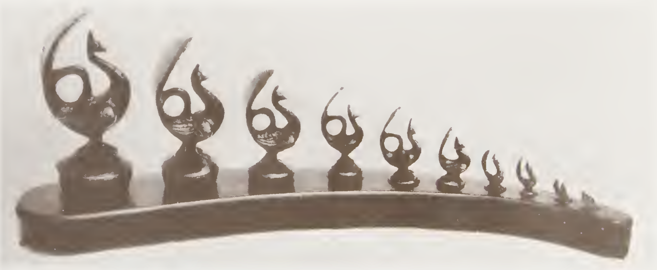


FIG 9. Tourist's "weights" in the form of peacocks.

NOTES

1. *Elephant weights will not be discussed as they were mainly restricted to the Shan States.*
2. *There was no opium trade of any importance more than a century ago.*
3. *Survey by D.Gear on stalls in Mandalay, Pegu and Rangoon, in 1972.*

REFERENCES

Burma Research Society, Rangoon: *Various articles.*

Journal of the Siam Society, Bankok: *Articles, e.g. by U.Guehler.*

Internat. Numisamata Orientalia, London: *Articles, e.g. by A.P.Phayre.*

The Indian Antiquary: *Articles, e.g. by A.C.Temple.*

GEAR. D. *The Ancient Royal Animal Weights of Burma.* Not yet published, but the major source of information for my article.

Notes & Queries

NQ 51 POSTAL WEIGHTS 1/4oz & 3/4oz; 1/3oz & 2/3oz; and F.

The latest addition to my collection is a DeGrave, Short & Fanner postal scale of the 'ladder' type. It has four beams, three are pre-weighted to 1/4oz, 1/2 oz and 3/4oz, and the top beam for 1oz, with five rectangular weights in the base. Which country would have used the 1/4oz weighing plate ?

Query from V.Denford.

I have a letter scale made by S.Mordan & Co which has the usual weights from 4oz to 1/4oz, but it also has weights marked 1/3oz and 2/3oz. Please can you tell me what these weights were used for ?

Query from G.D.Thursby.

I have some letter scales stamped S.Mordan & Co London. The weights are somewhat peculiar. They are 2,1,1/2 and 1/4 ounces in weight, but are marked 4P,2P,1P,F and F. If you can throw any light on the mystery, I should be most grateful.

Query from W.A.Gelder.

REPLY from the Editor.

The DeGrave, Short & Fanner ladder scale was almost certainly made for use in England. The pre-weighted beams provided facilities for both inland and overseas mail. During the period 1840 to 1871 postage rates for inland mail were based on 1/2oz steps, called 'Postages'. This term was abbreviated on some weights to 1P,2P,4P etc, which corresponded to 1/2oz,1oz,2oz etc. Concurrent with inland Postages there were postage rates for overseas mail based upon a 1/4oz unit. Thus, the pre-weighted beams provided 1/4,1/2,3/4,and 1oz for the first four rates of overseas mail, and 1/2 and 1oz for the first two rates of inland mail. The loose weights enabled the rate for heavier items to be determined.

Weights for the 1/4oz overseas unit were sometimes marked simply 'F', which, according to the GPO Records Department, stood for Foreign. The 1/4oz rates applied only to mail carried by packet boats from Dover, via France. In the British Almanack for 1845, these rates for letters not exceeding 1/4oz, ranged from 10d to 1s 11d, according to the country of destination.

In 1869, a new agreement was reached with France and certain other countries, for postage rates based on 1/3oz, and these were current until the formation of the Universal Postal Union in 1875. The British Almanack for 1871, shows that the majority of countries were then subject to a 1/2oz rate, with the following exceptions :-

	Not exceeding 1/3oz.	2/3oz.	1oz.	each additional 1/3
Algeria, France	3d	6d	9d	3d
Dardanelles, Smyrna, Turkey	6d	1s	1s 6d	6d

	Not exceeding 1/4oz	each additional 1/4oz
Portugal	6d	6d

On the formation of the U.P.U. all member countries had a uniform overseas rate based on 1/2oz (15g) for 2½d. Although many countries were included in this Union, several remained outside the organisation for many years, including, surprisingly, most of the British Colonies.

NQ 52 HERBERT & SONS LTD

query from I.Herre.

Please can you tell me something about the following scale manufacturer ?

Herbert & Sons Ltd, 6 & 7 West Smithfield, London.

REPLY

from the Editor.

The firm was started by Thomas Herbert, and the first directory date I have found is 1844. By 1871, the firm was Herbert & Sons, but I do not have a record of when they became a Limited company. The firm was still in business in 1971, and they were manufacturers of scales, weights, measures and weighing machines.

NQ 53 BRYAN CORCORAN LTD

query from L.A.uit den Boogaard.

I recently obtained a very nice chondrometer, or corn scale. It is large and in a beautiful mahogany case 16 x 4 x 6 inches; contents of the brass bucket one pint, so this is a 64th part of a bushel; beam graduated 0 to 70 lb per bushel; maker Bryan Corcoran Ltd, 31 Mark Lane, London. Please can you date the instrument ?

REPLY

from the Editor

The firm of Bryan Corcoran started around 1800 and made chondrometers up to the early 20th century. It became a Limited Company in the late 19th century and was at 31 Mark Lane from 1901 to 1910.

NQ 54 WEIGHT WITH CROWN & SHIELD (NQ39)

reply from G.M.M.Houben.

This 2 pound weight seems to have a stamp with the coat of arms of Bavaria. The arms were also used in Liege (Luttich) by the prince-bishops, who were Bavarian in origin, and may be seen on many coin weights.

What a pity the mass of the weight was not given in grams. It would be much easier to identify.

READERS *Please note this helpful suggestion from Gerard Houben. If you send a query about identifying weights, please send the accurate mass in GRAMS. - Editor.*

Review

2000 JAAR GEWICHTEN IN DE NEDERLAND

by D.A.Wittop Koning
and G.M.M.Houben

This authoritative work is the major source of reference on weights, makers and adjuster's marks of the Netherlands, West Friesland and Belgium. It updates and extends the previous work of Zevenboom & Wittop Koning (1953), and presents essential detailed information for researchers and all who have an interest in Netherland's weights. The work includes social and economic aspects of weight manufacture and adjustment from Roman times to the 19th C, and the introduction of metric weights in 1820. Presentation is both functional and attractive, with 83 photographs, 4 beautiful colour plates, and hundreds of drawings of marks. Over 800 makers and/or adjusters are mentioned and much dating and biographical material is included.

To people who cannot read the Dutch language (like me), full use of the book is denied. Nevertheless, an immense part IS accessible to aid identification and dating of weights, makers and adjusters.

2000 JAAR GEWICHTEN IN DE NEDERLANDEN; D.A.Wittop Koning & G.M.M.Houben; 1980. 24.5 x 16 cm, 224 pages; fl84.50, from De Tijdstroom b.v. Lochem, Netherlands.

SCALES AND BALANCES

by J.T.Graham

This excellent little book is a comprehensive survey of the main scales of interest to collectors; coin, letter, precision, inspector's, bank, yarn, trade, bread, and apothecary scales; with all the major mechanical types illustrated in 37 photographs. There is an attractive mixture of common and rare examples, a useful glossary, and a list for further reading. The text contains much historical information and many hints for collectors.

As ours is a specialist Society, it is appropriate to mention the few errors so that research standards can be maintained; p8 Druggist's scales usually had scruple weights in addition to the drachms and grains mentioned; p8 Young & Son were at Bear St. from 1812 - 27 (not 1875); p22 The inverted Roberval was invented at least as early as the beginning of the 19th C, (not late 19th); p25 Cased weights were RARELY supplied with letter scales; p27 The centre right scale in the top picture is shown in Salter's catalogues as an egg scale (not letter), hence the shape of the pan. These few errors are greatly outnumbered by hundreds of accurate, useful and illuminating facts.

Scales and Balances is a companion volume to Weights and Measures by the same author (see Review EQM p226). Both are nicely presented, packed with useful information and incredibly good value for money. They should be on the book shelf of every collector, beginner and expert.

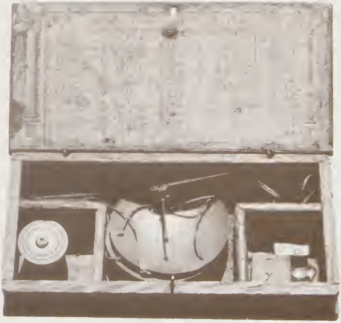
SCALES AND BALANCES; J.T.Graham; 1981. 21 x 15 cm, 32 pages; £0.95 plus post and packing, from Shire Publications Ltd, Cromwell House, Church St, Princes Risborough, Aylesbury, Bucks, England, HP17 9AJ, or available from ISASC.

Old Tenor

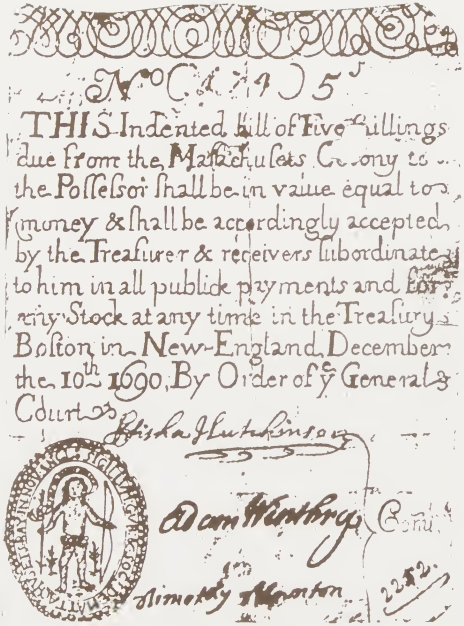
GEORGE MALLIS

At an antique show in early May, some years ago, my wife and I went from booth to booth looking for any items that would satisfy our rather catholic tastes in collecting small antiques. We have long had an interest in coin scales and counterfeit coin detectors, so it is understandable that we open just about any box we see, that might be a scale box. When we came to one particular booth, where there were several small boxes, we scanned the group carefully. One small oak box caught our attention. The cover was staple-hinged with an eye through it which engaged a small brass hasp. The top of the box was lightly carved in rectangular areas that resembled tooling on leather. This description fits the type of box used to house early equal-arm balances and weights, particularly those of English make.

Not daring to get our hopes up too high, we opened the box and nearly burst with enthusiasm. Not only was there a coin scale with weights in the box, but the lid had the original contemporary label that went with the box. We asked the price, paid it without reservations, and took possession of our prize. The rest of the show was anti-climatic....as you can imagine, we were anxious to get home and research our latest find.



Upon arriving home, we carefully studied the scales, weights, and particularly the label. To our surprise we found that the label carried the name "R.Billings in Corn Hill, Bofton." Examining the weights showed each weight to be stamped with a 'lion passant'. This was the assay mark of Goldsmith's Hall in London and was used as a verification mark on coin weights used in England. There was no question that those weights were of English origin. The American Colonial label on the lid posed another problem, though. Some further research into Sheppard and Musham's *Money Scales and Weights* turned up this same label except that the name Billings is replaced with "Sold by Lewis Deblois at ye Golden Eagle Dock Lo." Obviously, our scale, box and weights were all of English origin, c1740, and had been sent to the American Colonies to be sold,


No (474) 5s

THIS Indented Bill of Five Shillings due from the Maſſachuſets Colony to the Poſſeſsor ſhall be in value equal to money & ſhall be accordingly accepted by the Treaſurer & receivers ſubordinate to him in all publick payments and for any Stock at any time in the Treaſury Boſton in New-England December the 10th 1690 By Order of ye General Court

Elisha Hutchinson

Adam Winthrop Comt

Timothy Thornton

2252

Massachusetts Colony
5 shillings eventually
known as Old Tenor.

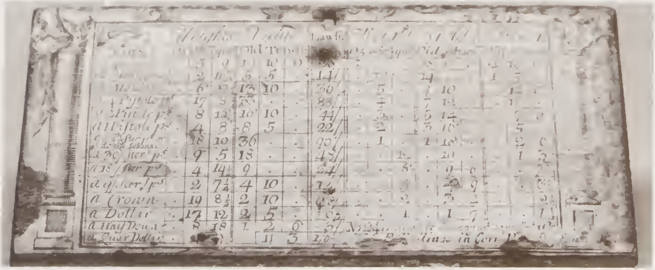
Illustrations of Tenor notes from 'Early Paper Money of America' by Eric P.Newman.

and for that purpose some Colonial agent's name had been substituted for that of the English maker or seller. We were determined to try and find out who R.Billings of Corn Hill, Boston was, so we tried the local library reference books, but even the library in Boston did not have records going back that far. We seemed to have come to the end of the line.

Time passed and while we slowly added more items to our antique scale collection, there was always in the back of our minds this matter of 'Billings'. While on a trip to my alma mater, the Worcester Polytechnic Institute, we went by The American Antiquarian Society building that adjoins the campus. Here we realised we might find the answer to our research problem, for the American Antiquarian Society dates back to Colonial days and is, perhaps, the finest facility of its kind in the world in which to do Colonial American research.

Stopping in, we made arrangements to come back in a few days and do some research on this mystery. About a week later we arrived at the Society with our little treasure and went to see one of the staff members. She was very helpful and offered to assist us in our research. We showed her the scale with its label and pointed out that we were interested in tracing down this mysterious R.Billings of Boston. "Why", she exclaimed,"this is a coincidence, for just yesterday there was a Western descendant of the Boston Billings here doing some research on his family geneology, and I assisted him with the references. So, I know just what book you want." She left us and in a short while returned with the Billings geneology for the mid 1700's. In no time at all we found that the R.Billings in Corn Hill, Boston, were merchants there from 1735, and that the sale of items such as scales would have been within their sphere of business. The mystery of the English scales offered for sale in the Colony of Massachusetts was finally solved.

There was still the strange label with its reference to foreign monies and their value in "Sterling" and "Old Tenor". But here we were on more familiar ground. At home some time spent with Eric Newman's monumental work *The Early Paper Money of America*, clearly revealed that the paper money of the early Massachusetts Bay Colony was called 'Tenor' in 1690, and that several issues of this money were released starting in that year and ending in 1741. There were three basic issues. The first was called 'Old Tenor', the 1737 issue became 'Middle Tenor', and the final issue was called 'New Tenor'.



The label showed that the value of a guinea (21 shillings) had a lawful value of 28 shillings in the Massachusetts Bay Colony. I questioned then why it took 10 pounds and 10 shillings in 'Old Tenor" for the same guinea ? To fully understand this, it is necessary to go back in the 1680's, when England was engaged in a struggle in Canada with the French and their Indian allies in what later came to be known in the Colonies as the French and Indian Wars. Massachusetts, like the rest of the northern colonies, sent men to these expeditions because these colonies were the target of attacks from the north. After a series of battles and skirmishes that ended when the English finally defeated the French in Canada, the men of Massachusetts returned home. In 1690, in order to pay for the service of these men, Massachusetts issued the first public paper currency in the Western World. The issuance of this paper money was necessary because this colony, like the rest of the Colonies, did not have any great amount of gold and silver coinage. England kept the American Colonies very short on metallic coinage.* What little there was available had to be used to pay for import duties on goods received from England. While seldom noted in many history books, one of the primary causes of the American Revolution was the economic squeeze put on the Colonies by the English authorities. This did much to affect the life and commerce of the American Colonies, and finally culminated in the American Revolution.

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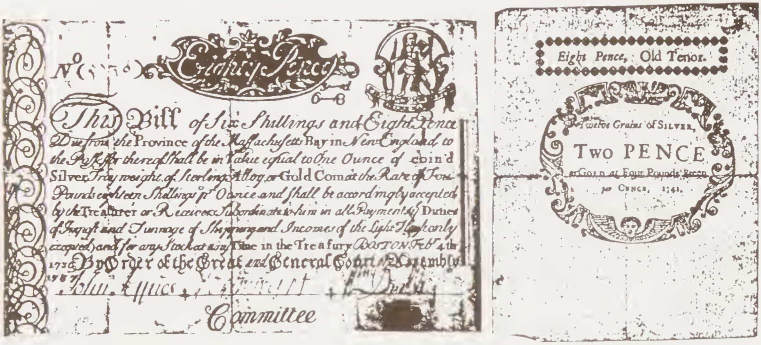
* *It is also a matter of history that England, herself, was desperately short of coinage at this time, and was unable to supply her own needs, never mind those of the Colonies. - Editor.*


Eighty Pence
6-8
This Bill of Six Shillings and Eight Pence Due from the Province of the Massachusetts Bay in New England to the Possessor thereof shall be in Value equal to One Ounce of coin'd Silver Troy weight of Sterling Alloy or Gold Coin at the Rate of Four Pounds eighteen Shillings pr Ounce and shall be accordingly accepted by the Treasurer or Receivers Subordinate to him in all Payments (Duties of Impost and Tunnage of Shipping and Incomes of the Light House only excepted) and for any Stock at any Time in the Treasury BOSTON Feb 4th 1736 By Order of the Great and General Court or Assembly
Committee
Eight Pence, Old Tenor.
Twelve Grains of Silver,
TWO PENCE
or Gold at Four Pounds Sterl
per Ounce, 1741.

LEFT: New Tenor or Three-Fold tenor, later called Middle Tenor. RIGHT: New Tenor or Second New Tenor.

On December 10th, 1690, the first public paper currency made its début in the form of 7000 pounds. Successive issues of paper money were released up until 1736. These notes were legal tender for all public payments, except for import duties or lighthouse fees. Needless to say, this paper money, having no backing in gold and silver, soon lost most of its value and inflation set in. By 1736/37, the value of this first issue of paper money had been so eroded that Massachusetts was forced to devalue it by printing a new issue to replace the earlier one. On February 4th, 1736/7, the new paper money was issued and called 'New Tenor' or 'Three-Fold Tenor'. This came about because one of the new bills had a value equal to three times the old or original bills. The original bills were then called 'Old Tenor' to distinguish them from the 'New Tenor'. As one can well imagine, this caused a great deal of difficulty and suffering among those who had a substantial amount of 'Old Tenor' and saw its value reduced to one third almost overnight.

Inflation continued at so rapid a rate, that by 1741/2, Massachusetts was forced to print a second issue of 'New Tenor' which had a value of four times the 'Old Tenor'. The issue of 1736 became know as 'Middle Tenor' and the 1741 issue became the 'New Tenor'.

Finally, on March 21st, 1749/50, the English government sent the Massachusetts Colony the sum of 183,649 pounds sterling to pay for its share in the French and Indian Wars fought some fifty years before. Massachusetts used this money to redeem the paper it had issued and did so for a period of one year. The exchange rate was as follows:

1. For the 'Old Tenor'; one Spanish milled dollar with a lawful value of 6 shillings, for 45 shillings in paper money.
2. For the 'New Tenor' or 'Middle Tenor'; one Spanish milled dollar with a lawful value of 6 shillings, for 11 shillings 3 pence in paper money.

This brought to a sad end this early experiment in paper money that did not have any metallic backing of gold or silver. The Massachusetts Bay colonist had to learn this economic lesson the hard way, but only time will tell if the government will ever find the wisdom to learn from the past and quit making the same mistakes which history has already proved to be folly.

REFERENCES

NEWMAN, Eric P. *The Early Paper Money of America, 2nd edition, Racine, Wisc. Western Publishing Co, 1976.*

SHEPPARD, T & J.F.MUSHAM *Money Scales and Weights, reprinted Spink & Son,Ltd, London, 1975.*

George Mallis' article is republished by courtesy of THE NUMISMATIST, official publication of the American Numismatic Association, P.O. Box 2366, Colorado Springs, Co 80901, U.S A.

Showcase

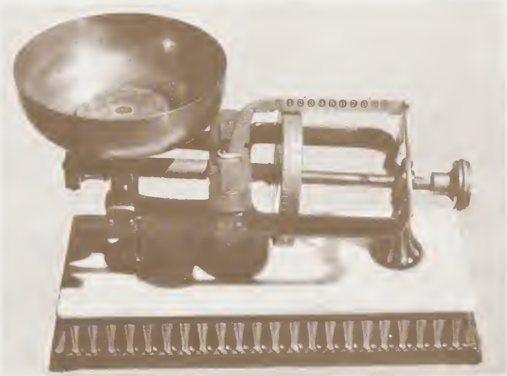
1. 'Micrometer Scale' manufactured by the Dodge Manufacturing Co, Yonkers, New York, USA. Cast iron with a white marble base. Beam graduated 0 to 10 pounds, 'micrometer' wheel graduated 0 to 16oz.x $\frac{1}{4}$oz. Base 450mm ($17\frac{3}{4}$ins) long. Brass pan stamped "Made in U.S.A. 1860".
FORREST EAKIN COLLECTION

2. Candlestick-type spring balance for weighing letters. Brass, with polished black stone base inlaid with 17 different types of stone, in 29 pieces. Postage rates for the period 1840-1871. Height 272mm ($10\frac{3}{4}$ins). A red paper label under the base states "From Woodruff's Bee Hive Bazaar, 35 Lower Parade, Leamington." (England). No maker's marks.
SJOERD BRUINSMA COLLECTION

3. Pendulum letter balance marked: COLUMBUS, 'M' in a square set on its corner, U.St.Pat. March 20th 1906, October 23rd 1906, Canada July 9th 1907. Graduated 0 to 4oz and 4 to 16oz. Brass with black painted cast iron base. Height 200mm (8ins).
DICK CHITTY COLLECTION

Photographs for SHOWCASE should be sent directly to the Editor (address inside the front cover). Please send black & white negatives if you can (not colour).

1



SHOWCASE

3

2

Contemporary Comment

"I cannot, however, help refreshing your memory on the subject of certain special and very ingenious methods of weighing which, as I think I once told you, I observed in Spain on my first journey to that Court, Thirty years ago. It was at the house of Don Hieronimo de Avanza, Chief Assayer of Mines of the West Indies, in the Royal Council. The first method was derived from Archimedes, as I have seen a fragment of his 'De Subsidentibus Aquae', and consisted of the same test which he made to determine the different metals in the crown of Hiero. This Don Hieronimo had a little silver scale which, to my eye, appeared to be of a one-third section of a sphere; on the outside were inscribed an infinite number of concentric circles, each bearing a numeral in the minutest characters, although there was hardly space for them between the lines. After suspending this scale by three or four threads from a movable rod, to form a balance which could be lowered and raised, when placed across another rod standing upright like a fork, he loaded the scale with whatever he wished to weigh, and let it descend as far as it would go into a basin full of water. Then at the instant he observed it was no longer sinking he noted the circle which touched the surface of the water. And from that he knew how to calculate the weight very precisely, even to the most imperceptible difference. The other method of weighing was also very ingenious, in my opinion. It was done by means of a straight brass rod which stood upright on a flat surface, likewise of brass. At the top of the rod there was an extremely fine steel needle which by its sharpness formed an indivisible point. Then he took a small silver scale, made with such accuracy that he assured me he had worked six months in order to have it of equal thickness throughout. For therein lies the whole secret. The centre was marked by an indivisible point on the convex side of the scale. Now when this was placed on the point of the needle, it was held in equilibrium, and was so sensitive that, as I myself have seen, the slightest particle of human hair placed on one side would set it in motion and cause it to incline perceptibly to that side. This man also possessed a series of weights so minute that the smallest of them were practically invisible, and the difference between them imperceptible; but each was designated a number. These weights he placed on one side of the scale and the object to be weighed on the other. He said that this type of balance was the most precise and exact in the world. But with regard to ancient weights, I do not know whether they ever attained such subtlety."

DECEMBER 18th, 1634.

From 'The Letters of Peter Paul Rubens' translated by R.S.Magurn, Harvard.

Erratum

The underlined spelling corrections should be made to the Article Japanese Scales and Weights, by Dr.S.Iwata. Apologies to Dr. Iwata - Editor.

Page 321, para 1, line 3, hakari-za : para 4, line 1, zoge bakari :

Page 322, lower panel, line 5, Kaki Sao Bakari : line 7, Kosao Bakari :
line 11, Kaki Sao Bo :

Photograph Scales & Weights!

MICHAEL CRAWFORTH

As Editor of Equilibrium, I receive many photographs which I would like to publish, but which are unsuitable for printing. Usually, all that is lacking are a few simple steps in arranging the lighting and using a suitable plain background. Anyone who is competent at taking holiday snaps can take good photographs of scales and weights if they follow simple, non-technical guidelines.

Scales and weights require their own technique of photography,(which you will not find in photographic manuals because they concentrate on portraiture, landscapes and holiday snaps for which the vast majority of cameras are used). Experienced photographers can take good photos in all kinds of conditions and with various types of cameras and lighting, but if you are not highly experienced, it is best to stick to standardised conditions to get reliable results. The following methods are my own, developed while photographing thousands of scales and weights in museums and private collections. Some of the results can be seen on the front covers of Equilibrium.

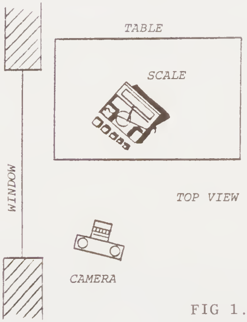


FIG 1.

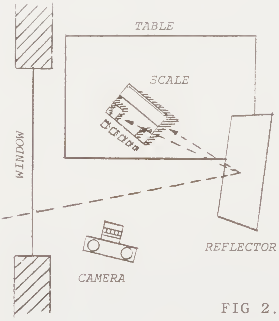


FIG 2.

LIGHTING

The simplest lighting is natural daylight, but do not take photographs in direct sunlight, because the shiny parts of the scales will be too bright and the shadows will be too dark, to show detail. Take photographs indoors on a table close to a large window which does NOT face the sun. Arrange the scale so that the light from the window falls on the scales and shows them clearly and attractively. For example, a box of coin scales with the maker's label in the lid, should be arranged at an angle which puts the brightest light on the label, Fig 1. Be careful not to get shadows from the window frame falling across the scales, or anywhere else in the picture. Arrange the scales on top of the open box so that the design of the beam can be seen, and place the weights in front of the box. Check that there is a tiny gap between adjacent weights when seen through the viewfinder.

SHADOWS

At this stage, there is a nicely arranged picture with strong lighting from one side. YOU will be able to see the detail in the shadows, but the CAMERA will not, because the photographic process is much less sensitive than the human eye. You must learn to judge what the camera will see. To make detail show in the shadows inside the box and at the side, you will need a reflector to divert light from the window into the shadows. Use a piece of white paper or a piece of aluminium kitchen foil glued to the textured side of a piece of hardboard. Rub the foil into the texture so that the reflected light is scattered, otherwise you will have bright blotches on the scales. The foil reflector is much better than the paper, as it reflects more light.

Hold the reflector near the scales on the opposite side to the window, and move it about and change the angle until you get the most light into the shadows. If you are careful you will also be able to make the scale, pans and weights show brightly. If necessary, try different positions and angles for the scales and weights, and add extra reflectors. Fig 2.

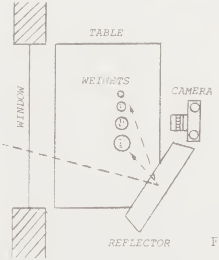


FIG 3.

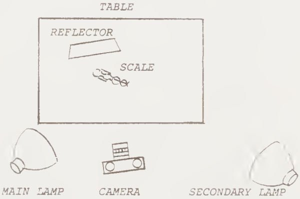


FIG 4.

Remember that shadows occur within the structure of some scales, and here you must arrange the lighting for the best position to prevent the shadow obscuring important detail, and then use reflectors to get light into the shadows. Of course, you must retain gentle shadows because they give three-dimensional form to the photographic image, so that round parts look round, not flat.

CHECK FREQUENTLY

Taking good photographs needs careful checking of many small things. Look at EVERY part of the scales or weights to see that they are clearly lit. Make sure the shadows have some light reflected into them. Avoid shadows from the window frame and don't let the reflector show in the picture. All arrangements MUST be checked in the viewfinder.

The simple reliable lighting explained above is suitable for many scales and weights, but before taking a photograph you must arrange an appropriate background for the picture, and set-up your camera correctly. These aspects will be explained later.

BETTER SIDE LIGHTING

You will be able to show better detail in the shadows if you use a lamp, instead of a reflector. An ordinary domestic lamp is not suitable, you must get a photoflood lamp from a photographic supplier. A 75w photoflood is adequate, and it will produce a much brighter light than a 150w domestic lamp (but will have a shorter working life). The photoflood can be fitted into an ordinary desk lamp with an adjustable arm (be sure to get a photoflood with the right end-fitting for the socket). Of course, a proper photo light stand is better.

Returning to the arrangement with the coin scales, Fig 2. place the lamp in a similar position to the reflector, and adjust its angle and position for the best results when looking through the camera viewfinder. Although the lamp replaces the reflector for the side lighting, you will find the reflector invaluable for giving a little extra light, possibly for making the scale beam or weights show clearly. To do this you will need to try the reflector in all sorts of strange positions and angles, whilst looking through the viewfinder. An assistant may be necessary.

VIEWFINDER

Be careful to arrange your lighting for the best effect when looking through the camera viewfinder. You will see all sorts of nice effects from other positions which cannot be seen in the viewfinder. If necessary, you can move the camera position, but this could affect what you can see of the scales. Think about strangers looking at your photograph - what will they want to see? What do you want to show them ? Can these things be seen in the viewfinder ?

Remember, what you can see with human eyes, and what you KNOW is there on the scales or weights, cannot always be 'seen' by the camera. The viewfinder is the ONLY criterion. What you see there, is what the photograph will show, if the lighting and exposure are correct.

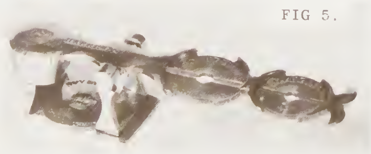


FIG 5.

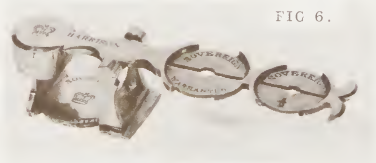


FIG 6.

The above method of using natural daylight from a window, supplemented by a reflector or a lamp, will enable you to take many photographs satisfactorily, but it is only suitable for use on a bright day, preferably with thin cloud cover to reduce glare.

ARTIFICIAL LIGHT

If you want to be independent of weather conditions you will need to get two photoflood lamps on proper adjustable stands. Use one lamp fairly close to the scales (say 600mm or 2ft) to replace the window, and the other lamp about twice as far away to replace the reflector. Adjust angles and positions, as before.

BACK-LIGHTING

Some scales with a flattish top, and some flat weights, may have interesting names or designs which you wish to photograph. A different technique is needed. called back-lighting.

Place the weights on the table in front of the window and locate the camera directly behind them, Fig 3. Move the camera up and down until you see a bright reflection of light from the top of the weights revealing all the marks clearly. Again, use reflectors to show detail in the shadows, otherwise you will have clear tops on shapeless black blobs which merge into the cast shadows.

FIG 7. A poor angle of view.

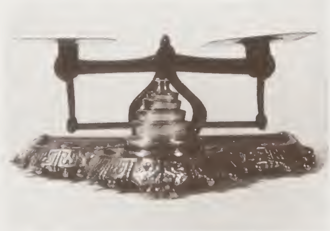
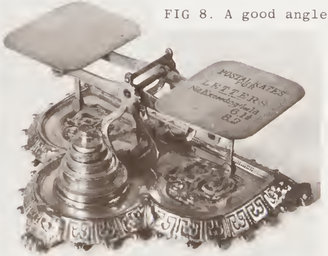


FIG 8. A good angle.



Alternatively, try using two lamps, as before, but with a reflector held behind and a little above the scale. Adjust the position of the reflector until the detail shows on top of the scale, but be careful not to let the reflector show in the picture. Figure 5 was taken with the lamps, alone, while Fig 6 had exactly the same lighting and camera positions, but with the simple addition of a cardboard reflector. This arrangement is shown in Fig 1.

ARRANGEMENTS

So far, the scale box with a label and the weights have required specific arrangements to show the writing or the marks. But, a scale without marks provides the opportunity to use a variety of arrangements, according to its design, artistic taste and what you want to show people. Usually, you should avoid showing a scale straight on from the front, because it does not give people much idea of the overall shape and design, Fig 7. It is far better to place the scale at an angle and raise the camera to look downwards, Fig 8. In this way, the shape of the weight plate, letter plate and shaped base can all be seen and the general design is more easily understood. In Fig 7 no idea of these shapes is given.

Suppose the scale shown in Fig 8 has postage rates on the letter plate, then return to the back-lighting technique. But this time, you will need a lamp, not a reflector, to provide sufficient light for the front of the scales, Fig 9. Try to retain the interesting angled view which shows as many parts of the scale as possible.

You can also use the back-lighting technique for marks on a vertical surface like a spring balance with a brass dial. Place the scale on the table (or suspend the hanging type) at an angle to the window and move the camera around horizontally to find the best reflections, Fig 10.

SETTING-UP

Be prepared to spend at least half-an-hour setting-up your background and lighting. Once this is done, you can take the photographs fairly quickly. If many scales have to be done, divide them into groups of similar size, and into groups of a similar type. Take photographs of all the scales in the group one after the other, so that few adjustments will be required to the camera or lighting, until the next group is dealt with.

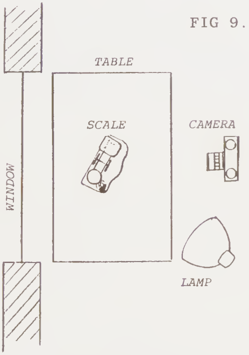


FIG 9.

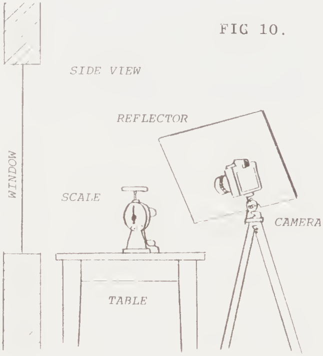


FIG 10.

BACKGROUND MATERIALS

All the work on lighting will be wasted if the background behind the scales or weights is cluttered with furniture and television sets ! You MUST use a plain background, preferably a piece of paper (or cloth). For black-and-white photographs you will need white, gray and black paper or thin card, about 20" x 30" (or A2 size). When the scales or weights are dark coloured, use the white paper. If they are pale or shiny silver use the black card, and if they have some pale colours and some dark colours then the gray paper will give the best results. Learn to see the scales in light and dark tones, not in colours. A mid-blue painted scale which you see clearly against a gray paper, may be seen as the same gray as the paper by the photographic system - like a black cat in a coal cellar !

Backgrounds for colour photography can be much more subtle. All kinds of colours can be used, but be careful not to have too many folds in cloth, or to use patterned material. Both can clutter the picture with background shapes which distract the eye and make it difficult to see the real shape of the scales. The choice of colour is a subjective decision, but here are a few general hints. Golden yellow brass looks superb on dark red , or mid-blue velvet. Silver or nickel-plated scales look warmer on dark red, mahogany boxes are enhanced by a soft green or gray-blue background. You must experiment.

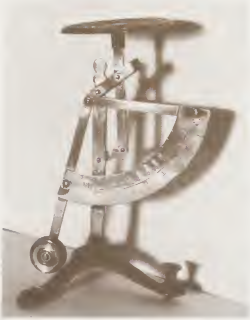


FIG 11. Heavy shadows confuse

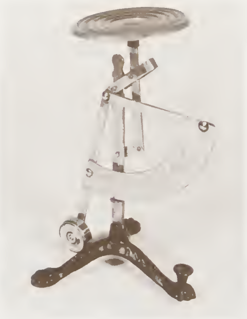


FIG 12. Light shadows provide clarity.

SHADOWS ON THE BACKGROUND

Using these simple techniques, it is inevitable that shadows will be caused by the lighting, and it is all too easy not to notice them because the human eye is selective in what it sees - the camera is NOT. If shadows are too dark and too close to the scales, their design will be obscured by the confusion of real shapes and shadow shapes, Fig 11. In this figure, the white background has been placed too close to the back of the scale - a basic mistake.

With the same scale and the same lighting, an infinitely better photograph can be taken if the white paper is as far away from the scale as is possible. In this way, the shadows are thrown some distance behind the scale, and they are also much paler, Fig 12.

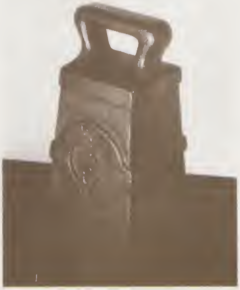


FIG 13. Bad choice of background.

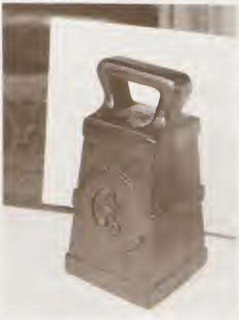


FIG 14. Background too small.

LINES ACROSS THE BACKGROUND

Another common mistake is to place the scale or weights on a dark wood table and then to use a white background, the result, for example, is that the bottom of a dark weight is almost invisible against the dark table, Fig 13. Also, an ugly division cuts the background in two. Unattractive pictures result when joints in the background material show as lines across the back, and from backgrounds which are too small so that dark corners appear in the photograph, Fig 14.

The arrangement used to avoid these mistakes is shown in Fig 15. A small rug or carpet is laid on the table and curved gently upwards over a stick or broom handle supported by piles of books. The carpet supports the background material smoothly without wrinkles. G-cramps hold the carpet in place.

The scale is placed ON the background material so the same surface appears all round the scale in the final picture. By curving the paper upwards behind the scale the background will fill the entire viewfinder. If the paper is not big enough, use two pieces overlapped, with the nearest sheet on top of the other, so the join does not show. Alternatively, for a very large scale, use a bed sheet, or blanket.

Of the many photographs the Editor has been sent, more have been spoiled by cluttered backgrounds and close heavy shadows, than by any other feature. Most people have handled the camera itself, reasonably well. ▷

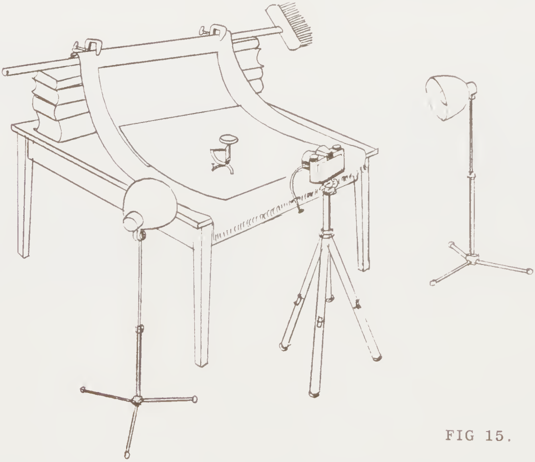


FIG 15.

AUTHOR'S NOTE: The original photographs used to illustrate this article show clearly the characteristics described. However, some of the subtleties may be lost in the printing process.

CAMERAS

Almost any camera, cheap or expensive, CAN take good photographs in the right conditions. I find the best is a manually controlled single-lens reflex 35mm camera with extension tubes and a hand-held light meter. If you have a fully automatic camera with a built-in light meter, then you have a slight disadvantage. I will explain why.

The automatic camera is designed to work on average light readings at a speed which prevents the effects of camera shake. This is ideal for holiday snaps - the main purpose of such a camera. But for photographing scales and weights, there are disadvantages. Supposing you have a small set of octagonal weights with a rich dark patina, on a large white background. The majority of light 'seen' by the built-in light meter is from the white background, so the automatic exposure will be ideal for white paper but useless for the weights, which will appear in the photograph as a black formless silhouette. Similarly, if you have a little nickel-plated coin rocker on a black background, the camera exposure will be based on black, so the rocker will appear in the photo as a formless white silhouette, Figs 16 & 17.

With a manual camera and a hand-held light meter, you can take a meter reading CLOSE to the scales or weights and set the camera precisely for them, ignoring the background.

So, what can the automatic camera user do to overcome his disadvantage ? Try using background materials with a tone fairly close to that of the scales, a mid gray perhaps ? And, take the camera as close to the scales as possible within the range of focus, to reduce the area of background seen.

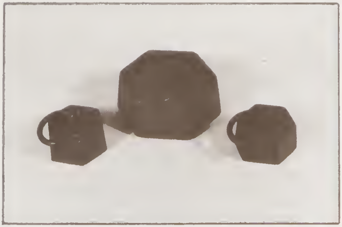


FIG 16. Over-exposed, no detail.

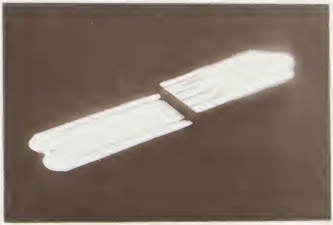


FIG 17. Under-exposed, no detail.

It is essential, when using a 35mm camera, to get as close as possible so the scale completely fills the viewfinder, Fig 18. A small scale in the centre of the negative, Fig 19, has to be enlarged so much for printing, that the grain of the emulsion gives a fuzzy appearance. For close-up shots of very small scales or weights you will need to use extension tubes for a camera with a removable lens, or an attachment lens for fixed lens cameras. A single-lens reflex camera is marvellous for this job because you can see exactly what the lens 'sees'. If you have another type of camera, take care with close-up shots because the viewfinder will not show exactly the same area that the lens covers. Read the manufacturer's instructions.

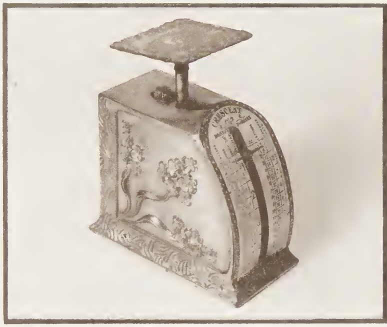


FIG 18. Fill the viewfinder.

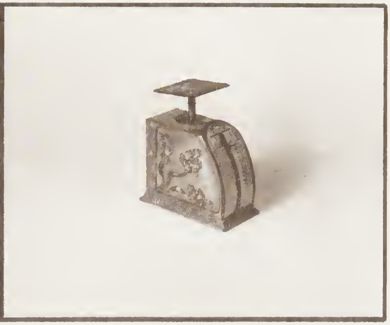


FIG 19. Too small for good results.

The second advantage of the manual camera is that you can always use a small aperture setting, f11. This gives the sharpest pictures and the greatest depth of field for the focus. If light conditions are poor, then you manually set a longer exposure, ALWAYS using a meter for the settings, of course. Many automatic cameras will automatically increase the aperture size in poor light conditions, in order to use faster speeds and prevent camera shake effects. Unfortunately, this reduces the depth of field and pictures are less sharp. Some automatics have a system whereby the aperture can be locked at any desired setting to overcome this problem.

TRIPOD

A most important aspect of camera use is avoiding camera shake. You must ALWAYS USE A TRIPOD for photos of scales and weights. If you have not got a tripod, buy one as soon as possible, and make sure it is strong and sturdy. A flimsy tripod is useless. Also, ALWAYS use a cable release to operate the camera.

FLASH

Many users of flash will be wondering why I have not mentioned this means of lighting. The reason is this. A single flash unit mounted on the camera is a very inadequate lighting for scales and weights. Sometimes it works well, but usually it does not. It gives flat lighting and heavy shadows so that scales appear to have little or no three-dimensional form and no detail can be seen in the shadows, Figs 20. Compare this with photoflood photo, Fig 21.

Vastly improved pictures can be taken if the flash unit is detached from the camera and set to one side, like the window, and a reflector or second flash unit is used on the other side. BUT the major disadvantage remains - the flash cannot be turned on and its position carefully arranged to light the scales to their best advantage and to show names or engraved decoration. You NEVER know what you have recorded on the film until the prints arrive - when it is too late to correct any faults. With natural light, or photofloods you can arrange every small detail correctly before committing the scene to film.

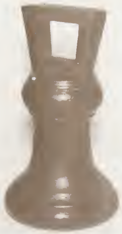


FIG 20.

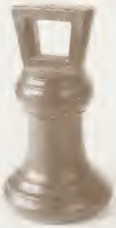


FIG 21.

PRINTS

Commercially processed prints, especially black-and-white, can be very poor. If you want good prints of your favourite scales or weights, use the custom service which many processors offer. It will cost more but the results will be a great improvement.

If you are sending photographs for publication in Equilibrium (and please do) send me 35mm black-and-white NEGATIVES, then they can be printed to the most convenient size for the magazine. Do not send colour negatives or colour prints as they make very poor black-and-white illustrations for printing.

FILMS

Although modern high-speed films are very good, the finest detail is best achieved by using slow film. I use Ilford FP4 rated at 22DIN (125ASA), but any equivalent by a reputable maker should suffice. Remember you must use indoor film for colour photographs using artificial lights, or daylight indoors.

RECORDING

If you are photographing several scales, and especially if they are similar in appearance, keep a record of every shot taken in the correct order. Include the number of the shot and brief details of the scales. If they are in a museum or in some private collection, record the owner's name and any reference numbers. Recording the lighting and camera settings used will help you to correct faults next time

PHOTO CHECK LIST

1. Use a plain background tonally different from the scales or weights.
2. Place the background material under the scales and curve it up behind.
3. Arrange the scales and weights for pleasing appearance and to show special features.
4. Light strongly from one side.
5. Light softly from the other side to weaken the shadows.
6. Check the viewfinder frequently while setting-up. You should ONLY see scales, weights and a plain background - there must be no bits of furniture showing in the corners.
7. Always use a tripod and cable release for the camera.
8. Use a small aperture, if possible, f11.
9. Always use a light-meter.
10. Record the number of the photo, details of the scales or weights and their location.

ISASC

EQUILIBRIUM

QUARTERLY MAGAZINE OF THE INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

AUTUMN, 1981 M.A. CRAWFORTH, EDITOR PAGES 373-400

PAGE 374

Letters

SCALE ENTHUSIASTS - A TERMINOLOGY ?

I have given agonizing thoughts to appellations in the scale field; they certainly have been wanting. I submit herewith, to you, the scholars and practitioners, the following for your approval, endorsement and usage :-

BALANCIOPHILE	: The collector, the lover of scales and weights, the connoisseur.
BALANCIOLOGIST	: The student, the scientist, the researcher, writer and teacher.
BALANCICIAN	: The technical expert, the technician, maker and designer of scales and weights.
BALANCIATRIST	: The restorer, repairer of scales.
BALANCIOGRAPHER	: The describer and classifier of scales and weights.

I would appreciate it if you would give consideration to this important matter !

FRITZ SCHMERL.

Members are invited to send their comments and alternative suggestions to the EDITOR.

Cover Picture

This egg balance, with a frame in the shape of a horseshoe, was made by Samuel Turner, Senior, of Birmingham, England. The design was registered by S.T.Lilly, of Birmingham, in 1924, No.703857. See page 381, illustration No. 12, for the egg and letter scale version.

The twisted brass wire egg holder is not a home-made replacement; it is original and several identical examples have been seen. It is a very functional receptacle which allows the egg to be placed and removed, quickly and conveniently.

INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

Bob Stein, President
20 North Wacker Drive, Chicago, IL 60606 U.S.A.

Michael Crawforth, Vice President
31 Park Lea, Sunderland SR3 3TA England

Robert Miller, Vice President/Treasurer
25W620 Indian Hill Woods
Naperville, IL 60540 U.S.A.

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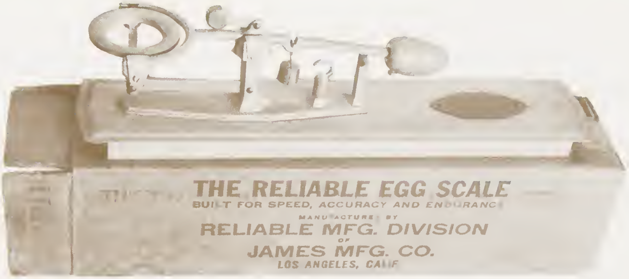


Egg Scales *(Pt.1)*

MICHAEL CRAWFORTH

Scales for weighing eggs, one at a time, were used to grade for sale, or to select eggs for hatching. There were a great many designs and methods of construction and, although they were of little aesthetic merit, their technical quaintness gave them great charm. Some scales showed considerable ingenuity in their design, as in those manufactured almost entirely from simple strips of sheet metal bent to the required shapes. Even though such scales were ingenious, their construction was frequently crude and the effectiveness of the designs varied considerably. Some were simple to use, easy to read and were very compact. Others were awkward to operate, difficult to read or had small loose weights which were easily lost. Little thought, if any, was given to the convenience of cleaning the scales, and the thought of having to remove the sticky remains of a broken egg from some of the intricate parts of the scales is most disagreeable. It would seem that many of the designers (or should I say perpetrators ?) had not tried using their scales in realistic conditions and did not project their imaginations to such mundane problems. However, for the collector, the visible mechanism of the scales can be a delight infinitely more interesting than smooth hygienic covers.

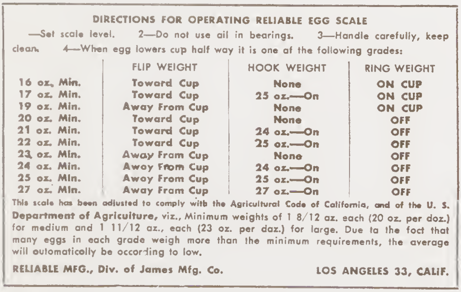
Many egg scales were made by manufacturers outside the scale industry, which probably accounts for some of the very curious designs. Although most of them were pendulums, unequal-arm balances or steelyards, the other basic scale types were well represented too:- Roberval, equal-arm with hanging pans, spring, bismar, weight-lifting beam and rocker. Several were adaptations of letter scales, and one or two even combined the two functions of weighing eggs and letters, Nos. 12 & 37.*

Some designs were extremely simple to manufacture and to use, like Nos. 4,8, 28,34,35 & 43, but this sometimes meant they were restricted to one grade only. This type was usually available for any one of the grades, so a poultry-

* *Numbers 29 to 49 will be shown in Part 2.*

man could buy a balance for each grade of interest, say large, medium and small. Steelyards, like Nos. 15,41 & 49, were relatively simple and they could weigh the full range of eggs with one sliding weight. Compare these easily used scales with others, like No. 7, which had three different types of adjustment, a captive swing-over weight, a loose hang-on weight and a weight ring which was placed on the egg pan. Confusing combinations of these three weights enabled the user to set the balance for any one of ten different weight values - see the instructions which, incidentally, were attached to the scale *underneath* the base, so the egg and the weights had to be removed before consulting them ! Fig 1. Number 25 was also complicated with a fixed weight, a captive weight which the beam collected, and a loose hang-on weight to be attached when required.

Innovators attempted to make non-self-indicating scales compete with self-indicating scales (spring and pendulum types) by adding automatic features to the basic design. Number 10 had the patented idea of a weight suspended by a thread above the weight plate. In use, the loose weights were placed on the plate, according to the middle grade required. Then the egg was placed in the pan. If the beam did not move the egg was a lower grade, if the beam balanced level it was the middle grade, and if it continued to tilt and was able to lift the suspended weight the egg was the higher grade.



DIRECTIONS FOR OPERATING RELIABLE EGG SCALE

—Set scale level. 2—Do not use oil in bearings. 3—Handle carefully, keep clean. 4—When egg lowers cup half way it is one of the following grades:

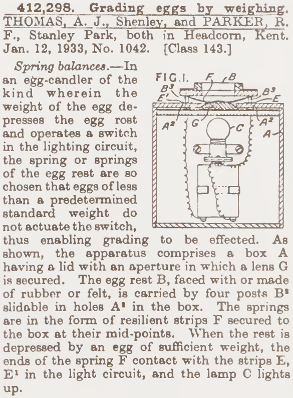
	FLIP WEIGHT	HOOK WEIGHT	RING WEIGHT
16 oz. Min.	Toward Cup	None	ON CUP
17 oz. Min.	Toward Cup	25 oz.—On	ON CUP
19 oz. Min.	Away From Cup	None	ON CUP
20 oz. Min.	Toward Cup	None	OFF
21 oz. Min.	Toward Cup	24 oz.—On	OFF
22 oz. Min.	Toward Cup	25 oz.—On	OFF
23 oz. Min.	Away From Cup	None	OFF
24 oz. Min.	Away From Cup	24 oz.—On	OFF
25 oz. Min.	Away From Cup	25 oz.—On	OFF
27 oz. Min.	Away From Cup	27 oz.—On	OFF

This scale has been adjusted to comply with the Agricultural Code of California, and of the U. S. **Department of Agriculture,** viz., Minimum weights of 1 8/12 oz. each (20 oz. per doz.) for medium and 1 11/12 oz., each (23 oz. per doz.) for large. Due to the fact that many eggs in each grade weigh more than the minimum requirements, the average will automatically be according to low.

RELIABLE MFG., Div. of James Mfg. Co. **LOS ANGELES 33, CALIF.**

FIG 1. Instructions for the Reliable Egg Scale, No.7.

FIG 2. (Right) Abridged patent for Thomas & Parker's combined weigher and candler.



412,298. Grading eggs by weighing. THOMAS, A. J., Shenley, and PARKER, R. F., Stanley Park, both in Headcorn, Kent. Jan. 12, 1933, No. 1042. [Class 143.]

Spring balances.—In an egg-candler of the kind wherein the weight of the egg depresses the egg rest and operates a switch in the lighting circuit, the spring or springs of the egg rest are so chosen that eggs of less than a predetermined standard weight do not actuate the switch, thus enabling grading to be effected. As shown, the apparatus comprises a box A having a lid with an aperture in which a lens G is secured. The egg rest B, faced with or made of rubber or felt, is carried by four posts B^3 slidable in holes A^2 in the box. The springs are in the form of resilient strips F secured to the box at their mid-points. When the rest is depressed by an egg of sufficient weight, the ends of the spring F contact with the strips E, E^1 in the light circuit, and the lamp C lights up.

Number 14 had telescopic weights on the beams and these were adjusted in or out to set the basic grades required. The egg was placed in the top pan and if the beam did not move, it was a lower grade. If the beam balanced level the egg was the pre-set grade, but if it was too heavy the beam tilted in such a way that the egg was automatically tipped into the pan of the lower beam. This pan had a suspended weight which distinguished another grade, as with number 10, described above.

A series of sheet aluminium captive weights were used on number 21. They were pivotted on the same fulcrum as the beam. Each successive weight was placed a little higher than the preceding one, in slots in a frame near the end of the base. Thus, when an egg was placed in the pan the beam started to tilt and 'collected' one of the weights automatically. It continued to tilt and collect further weights until there were enough to balance the egg.

A hygienic case over number 36 covered an unusual mechanism inside. The pendulum had a damper to reduce the number of oscillations, thus speeding the weighing process. The patent was obtained in 1932 and it stated that the balance was for use in selecting eggs for hatching or grading.

The idea of special scales for hatching purposes occured in a much earlier patent of 1913, by A.H.Piejus, Fig 3. It was a table-top steelyard which indicated the evaporation of moisture as a means of controlling incubation. The selected egg was placed in the pan and its weight ascertained by means of the sliding poise close against a fixed card graduated in bands marked with the letters A to H. Similar lettering was marked around a cylindrical card which could slide and rotate on the fixed card. After a period of incubation, say ten days, the egg was again balanced and the cylindrical card was moved up to the letter originally ascertained, and was then rotated until the graduations marked with the same letter on the cylinder came opposite the newly adjusted poise. If the evaporation of moisture was normal, the poise pointed to ten days, the period so far incubated. Lower or higher readings indicated that the evaporation should be hastened or retarded, in order to complete incubation.

Piejus' design for an incubation scale seems to have been ahead of the main trend towards weighing eggs for general commercial purposes. In America, arguments in favour of selling eggs by weight were raging around 1915. Reasons for weighing eggs included the fact that rotten, stale or long-stored eggs could be more easily detected by loss in weight, than by any other means. Also, there was the problem of variation in size (± 25% of the standard weight), which made sale by number unfair. Weighing was also seen as an incentive to poultry farmers to clean their eggs for sale - no dealer was going to pay for dirt !

There were advantages in selling eggs by number, too, particularly for handling and packaging. In the end, a compromise was adopted. Eggs were graded by weight and quality, prior to selling. They were then sold by number (and this still applies today). The factors considered in classifying eggs were as follows:-

1. Condition of shell - cracks, general cleanliness.
2. Air cell size - indicating the extent to which moisture had been evaporated from the contents, i.e. freshness.
3. Colour and firmness of the yolk.
4. Clearness and firmness of the white.
5. Visibility of the germ.
6 Weight.

The internal condition of the egg was ascertained by 'candling', whereby the inside was made visible by holding the egg in front of a candle or other light. In their British patent of 1933, Thomas and Parker combined weighing with candling in a single compact instrument, Fig 2. Their apparatus comprised an electric light visible through a hole in the top of a box, and a simple spring loaded egg holder suspended over the hole. An egg of the correct weight depressed the spring to close electrical contacts and thus turn on the light.

Patents for egg scales were being filed in America before 1920 and before standard criteria were established to select eggs for sale. It was not until 1925 that California, leaders in the field, settled on the first five of the above factors for grading eggs, in an attempt to standardize quality throughout the State. Apparently, it was a further eight years before weight was added to these requirements. The newly established grades were given in the 1933 California State Agricultural Code as :-

	1 1/4		1 7/12		1 5/6	oz.
	16		20		23½	oz per dozen
PEEWEE		SMALL		MEDIUM		LARGE

The following pages contain a survey of 28 egg scales known to the author, and a further 30 examples will be shown in Part 2, along with more information on egg grading in England, America, Germany and Canada.

KEY TO THE ILLUSTRATIONS

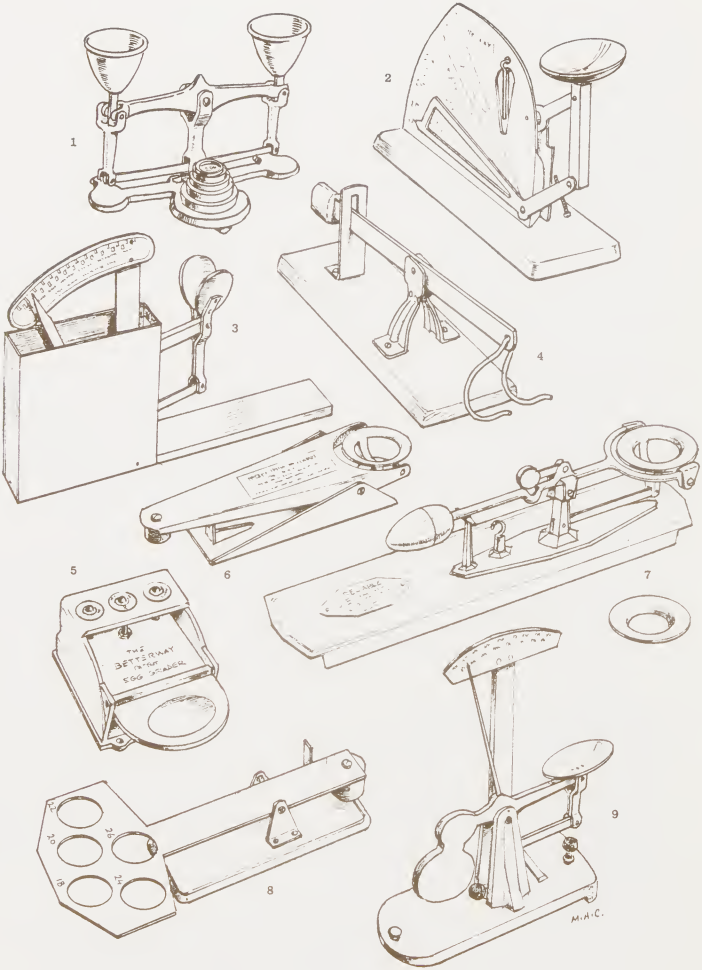
1. Unsigned. English. Gold painted cast iron base; aluminium cups; brass weights 2,1,½,¼oz,2,2 dram. Roberval type. Beam length 128mm (5").

2. Jiffy-Way Inc, Owatonna, Minn, USA. Patent No.2205917 (1940). Red painted sheet metal; aluminium pan; graduated 18 - 30oz per doz. and 1½ - 2½oz. Grades Small, Medium, Large, Extra Large; a wire split pin, suspended in the hole, serves as a level indicator. A screw stop is provided for under/over setting for a desired weight. Pendulum type; height 140mm (5½").

3. Reliable Automatic Dial Egg Scale, USA. Green painted sheet metal and wood; brass graduated arc; graduated 16 - 40oz per doz. (The extended wood base serves no apparent purpose). Pendulum type; height 222mm (8¾"). The open top case exposes the mechanism to dirt but gives virtually no access for cleaning.

4. Unsigned. American. Brass beam; lead weight; unpainted wood base; two grades 15 and 21oz per doz. The grade is selected by sliding the beam to one of two positions permitted by a crescent-shaped slot through which the pivot pin passes. Bismar type. Beam length 203mm (8").

5. Betterway Patent Egg Grader. English. Dark brown plastic with three steel indicator/weights marked Standard, Medium, Special. The rear end of the beam pushes up the weights, accumulating sufficient to balance the egg. Unequal-arm weight-lifting type. Width 82mm (3¼"). The makers claimed that this balance was capable of grading 1,600 eggs per hour ! The same design was also marketed as the Smallholder Egg Grader by Geo.H.Elt Ltd, Worcester, England, trade mark ELTEX.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THE BETTERWAY PATENT EGG GRADER
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M.H.C.

6. E - Z Egg Scale. Carlstedt Mfg. Co. Edmonds, Washington, USA. Red painted sheet metal; lead weight; brass egg holder; gold label with black letters. Unequal-arm type.

7. Reliable Egg Scale. Reliable Mfg. Division of James Mfg.Co. Los Angeles, California, USA. Marked "Built for speed, accuracy, and endurance". Cast alloy scale and stand; sheet metal base. The turn-over weight, loose hang-on weight and loose ring weight, when used in various combinations, set the beam for ten different weights from 16 to 27oz per doz. Other versions had different bases. Patented by Ellis E.Powell, Seattle Wash. in 1937, No.105970. Unequal-arm type, length of base 324mm (12¾"). See Fig 1. for the instructions for use.

8. A-B-C Egg Scale, USA, marked "Patent No.226712?."(1941). Gold painted sheet metal beam, black painted base. The egg sockets are marked 18,20,22,24,26. (oz per doz.). Unequal-arm type. A similar scale was marketed by Standard Egg Scales, Vancouver, Canada. Length 267mm (10½"). Also made with fewer holes for the eggs.

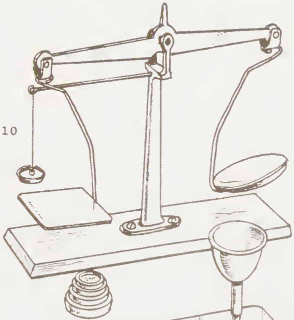
9. Zenith Egg Scale, USA. Red painted cast metal beam; red tipped pointer; blue painted cast metal base. The scale is provided with a levelling screw and two rubber buffer stops. These stops can be set by screws to indicate three grades without reference to the graduations. If the weight stays on its stop, the egg is the light grade. Heavy eggs bring the pan down on to the other stop, and the beam swings freely for medium eggs. Graduated 18 - 30oz per doz.. Pendulum type, height 195mm (7¾"). Compare with the freely suspended version, No.39.

10. Unsigned. English. Marked 'Patent No.429692' (J.Hunt, 1933).Black painted cast iron beam and column with simple gold painted decoration; brass pan and plate; mahogany base; brass weights 2,1,½,¼oz 2 dram. There is also a ¼oz weight suspended by a cord from a wire arm attached to the column (the subject of the patent). The scale automatically detects three grades, see page 376. Equal-arm beam with weight-lifting facility. Beam length 170mm (6¾").

11. Salter No.9E. Geo.Salter & Co.Ltd. West Bromwich, England. Spring balance with a flat brass face graduated 0 - 4oz x ¼oz. Brass hanger and pan. Overall height 300mm (11¾").Illustrated in catalogues of the 1930's.

12. Egg and Letter Balance, also marked STS (the trade mark of Samuel Turner, Senior, Birmingham, England). Cast iron frame in the shape of a horseshoe; aluminium plate dished in the centre to hold an egg; graduated 0 - 4oz x 2 dram; ivorine plaque carries postage rates "2oz - 1½d.each additional 2oz - ½d," (current from 1923 to 1940). Pendulum type; height 190mm (7½"). See Cover Picture for the version for eggs only.

13. Hartner, Germany. Pressed sheet metal case; test weight stored in a socket on top of the case; graduated 40 - 75 gram, with grades S,A,B,C,D and KLEIN. Pendulum type.



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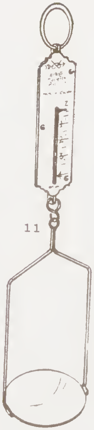

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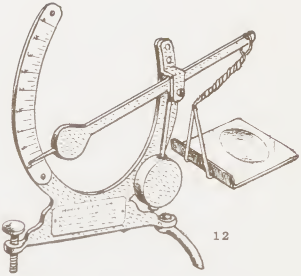

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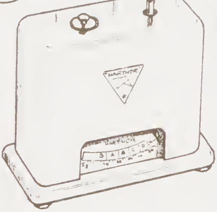

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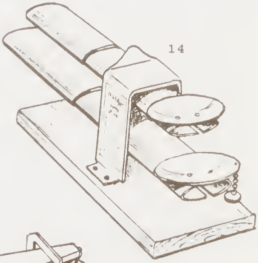

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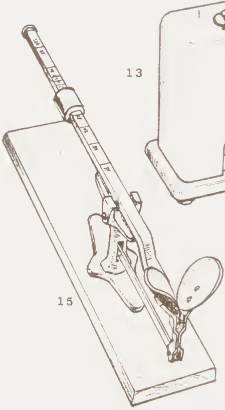

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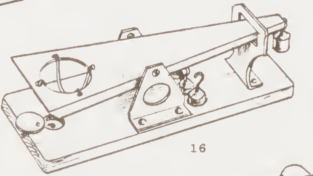

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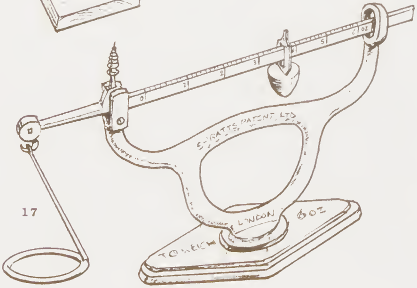

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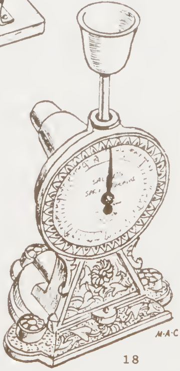

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14. The ABF Egg Scale, Mount Tacoma Mfg.Co. Tacoma, Wash. USA. Sheet metal construction; two beams with telescopic sliding weights; wood base. Label lists 19 to 24oz per doz. and 37½ to 47 lb. average weight per case. An egg too heavy for the top beam automatically tips on to the lower beam, see description on page 376. Unequal-arm type.

15. Reliable Egg Grader. Reliable Mfg. Division of James Mfg.Co. Los Angeles, California, USA. Brass beam; iron stand; wood base; beam graduated 16 - 32oz per doz., with a subsidiary mark at 23½oz. Steelyard type. Length 305mm (12").

16. The Gilt Edge Scale, White Mfg.Co, Gardena, California, USA. Patented by O.C.White, No.1259181, 1918. Green painted sheet metal; unpainted wood base; three hook-on lead weights stored in sockets in the base; three copper washer weights stored in a lidded locker with a swing-aside lid. The lead weights are suspended from the end of the beam, and set the grade to 18,22 or 26oz per doz. A washer weight can be added by slipping it over the hook of the weight. Each washer increases the capacity by 1oz per doz. Unequal-arm type. Length 228mm (9"). See Patently Interesting, p389.

17. Egg Weigher. Spratt's Patent Ltd. London. Brass beam, weight and hanger; black painted cast iron stand and base; marked "To Weigh 6oz"; graduated 0 - 6oz x 2 dram. Steelyard type.

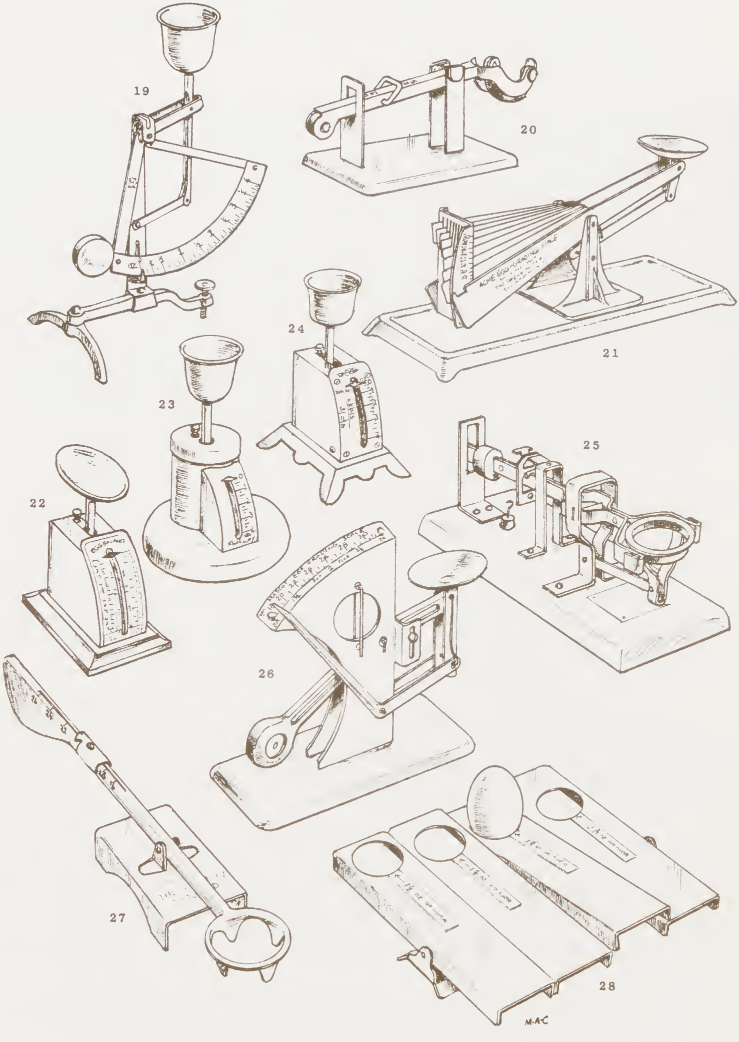
18. Salter No.11E. Geo.Salter & Co.Ltd, West Bromwich, England. Dark Green painted cast iron case; Brass egg cup; white enamelled face; graduated 0 - 6oz x 2 dram. Half-Roberval with spring; height 202mm (8"). Also made with a plain case No. 11ET, 0 - 8oz x 1 dram.

19. Marked with a letter M inside a form of star, (the trade mark of P.J.Maul, Hamburg, Germany). Brass egg cup and arms; steel quadrant; cast iron base painted black; levelling screw; graduated 0 - 4oz x 1 dram for the British market. Pendulum type; height 196mm (7¾").

20. EggXact Scales, 935 Delaware St, Berkeley, California, USA. Patent applied for. Painted sheet metal; wire turn-over weight can be set for 19 or 22oz per doz. Length 200mm (8"). Unequal-arm type.

21. Acme Egg Grading Scale. The Specialty Mfg.Co. St.Paul, Minn, USA. Patented by N.E.Chapman, No.1499153, 1924. Aluminium beam, weights and pan; painted sheet metal base. The sheet aluminium weights are pivotted on the beam fulcrum pin. As the beam tilts, it collects weights one after the other until there are sufficient to balance the load. Arc fixed to base is graduated 19 - 30oz per doz.. Unequal-arm, weight-lifting type. Base length 252mm (10"). Another version of this balance had the graduations marked on the end of each weight, not on an arc.

22. M.M. & S. Ld. B. (the initials of M.Myers & Son, Ltd. Birmingham, England). Black painted sheet metal case; chrome plated pan and base; graduated 0 - 4oz x 1 dram. Half-Roberval and spring; height 96mm (3¾").


19
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ACME EGG-GRADING SCALE
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EGG BALANCE
EGG GRADING SCALE
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28
M.A.C

23. Kwikway. English. Black crinkle-painted case; aluminium cup and card; graduated 0 - 4oz x 2 dram; Half-Roberval and spring; height 128mm (5"). Similar balances were in the catalogue of G.H.Elt Ltd, Worcester, England, called the ELTEX 'Royston'.

24. Salter No.18E, Geo. Salter & Co.Ltd. West Bromwich, England. Green painted sheet metal case; brass egg cup; graduated 0 - 4oz x 2 dram. Grades for hens' eggs are marked Pullet Medium, Standard, Special; and for ducks' eggs, Small, Standard, Special. Half-Roberval and spring. Height 120mm (4¾"). Another version had a shallow aluminium pan and a brass case which was copper plated and chemically blackened to give a mottled 'bronze' effect. This model was graduated 0 - 4oz x ¼oz, without grades.

25. Ward's Master Quality Egg Grader. Montgomery Ward & Co, USA. Galvanised metal strips; green painted wood base; fixed lead weight, hook-on weight and captive lift weight. The loose weight can be hung on the bottom of the captive weight when required. Light grade egg does not move the beam. A medium egg balances the beam level, while a heavy egg lifts the captive weight. The heaviest grade can be increased by attaching the hook-on weight. Unequal-arm with weight-lifting facility. Length 254mm (10").

26. Mascot Egg Grading Scale, USA. Black painted base and frame; aluminium pan; graduated 18 - 30oz per doz. and 1½ - 2½oz. Pendulum type, height 165mm (6½"). A similar scale was marked Oakes Mfg.Co.Inc. Tipton, Indiana, USA.

27. Oakes Mfg. Tipton, Indiana, USA. Galvanised metal beam; red painted metal base; sliding weight; beam graduated 16 - 26oz per doz. Steelyard type; length 295mm (11½").

28. Unsigned. English. Galvanised sheet metal; all four beams are identical apart from the location of the egg socket; beams marked 1 1/2oz or over, 1 5/8oz or over, 1 7/8oz or over, 2 3/16oz or over. Unequal-arm beams, length 216mm (8½"). A three-beam version 'The Bernard Egg Grader' was illustrated in a catalogue of 1939. It was marked Small, Standard, Special.

24,147. **Piejus, A. H.** Oct. 24.

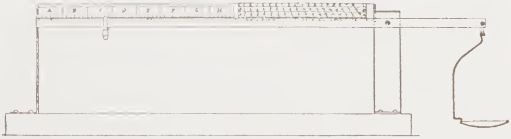


FIG 3. Hatching egg scale patented by Piejus, in 1913.

PART 2 of this article will be published in a future issue of EQUILIBRIUM.

European Porcelain Weights

GERARD HOUBEN

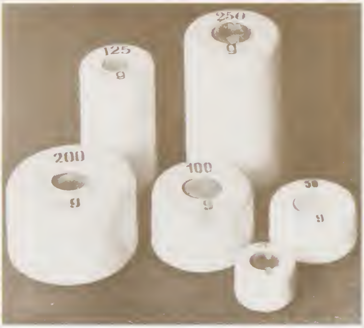


FIG 1. GERMAN WEIGHTS

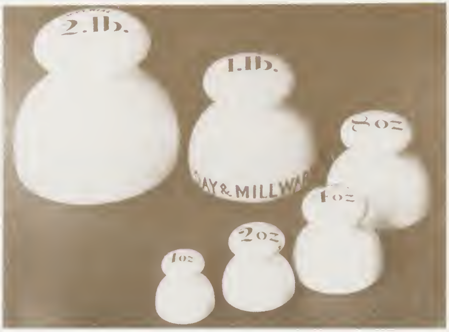


FIG 2. ENGLISH WEIGHTS

Until the beginning of the 19th century, shopkeepers were accustomed to using iron, brass and lead weights. However, there were disadvantages in these materials. Lead could be easily deformed and damaged, which would result in a deviation in mass, so, when authorities began to pay more attention to toxicity and hygiene, the use of lead weights in pharmacies and grocer's shops was forbidden. Brass and iron also had drawbacks, as they corroded when in contact with fish, meat, certain vegetables and acidic fruit juices. Thus, a need was felt for less vulnerable weights for use in dairy shops, fishmonger's and butcher's shops. As a result, porcelain weights came on the market in England* and in Switzerland during the 19th century.

Manufacturers of weighing machines were already familiar with the use of porcelain. Goods plates of several types of balances in common use were made from earthenware (and sometimes of marble) for hygienic reasons, and nicely decorated nameplates on balances were also often made of porcelain. In olden times, weights made from stone or from baked clay had been used frequently.

The expression "porcelain weights", although used internationally, is an incorrect term for weights of light-coloured earthenware which was given a thin layer of transparent or white "enamel" (glaze). The clay was fired between 1150°and 1300°C, and the glaze was applied afterwards and heated to 750°C. As the specific gravity of porcelain is much lower than that of brass or iron, porcelain weights were larger than metal weights of the same denomination. Adjustment was done by means of a large lead plug in a central hole underneath, or elsewhere.

** See Earthenware Weights, by Gillian Dick, EQM pp 83 - 86.*

In England, porcelain weights were first used commercially around 1845. They were approximately hemispherical and were provided with a nicely proportioned large round knob. The famous company Wedgwood was one of the most important producers, and their name was impressed in the bottom of the weights. Wedgwood also used a characteristic blue or pink coloured ornamental border around the base of their weights. On other examples, the names W & T Avery, Parnall, Day & Millward, etc, can be seen, and sometimes Imperial (which refers to the Imperial Standard introduced in 1826); Cased (which refers to the relatively large amount of lead used as a filling); or Enamel Weight (which refers to the glazed finish). The mass was marked on top of the knob and a series normally consisted of 1,2,4 and 8oz, and 1,2,4,and 7lb. Adjustment and stamping was done on the large lead plug, underneath.

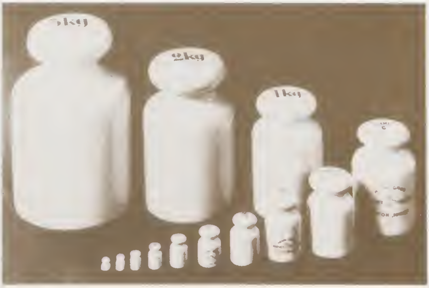


FIG 3. SWISS WEIGHTS

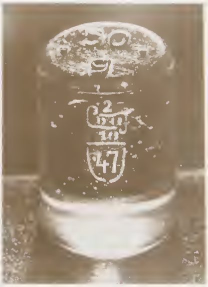


FIG 4. GERMAN GLASS WEIGHT

For a few years, Day & Co. sold porcelain weights of a rectangular form similar to iron bar weights. They were used as an advertisement, and are now a rather scarce curiosity.

It was only after a few decades of use that people began to realise that porcelain weights had a major disadvantage. They were very easy to chip, especially with the heavier weights, and the slightest damage or crack in the glazed surface led to the absoption of moisture, altering the mass. In 1889, the Board of Trade prohibited the further manufacture of porcelain weights, and in 1907, their continued use was forbidden.

In Switzerland, the initiative for manufacture of porcelain weights was taken by the porcelain factory of Henri Gros in Nyon. The shape of their weights reminds one of the electrical insulators which we used to see on telegraph poles. This is hardly surprising, because insulators were also made by Henri Gros.

In 1920, the production was taken over by the Porzellen-Fabrik Langenthal, run by a colleague of Gros, but it ended shortly after the second world war, due to declining sales. The weight series comprised all the usual denominations from 1g to 5kg, which were marked on the top. Sometimes, the name HENRI GROS BREVET No.18546, NYON, SUISSE was marked on the side, Fig 3. A series of the smaller weights, from 1 to 50g, can still be found in apothecaries' shops and in laboratories.

During the last years of the war, a limited quantity of porcelain weights was introduced into France, with the stamp of the well known French scale maker Testut. They had almost the same cylindrical form as the Swiss weights, but were known only in the denominations 100,200,500g and 1kg.

The most recent porcelain weights, which are still in use, were made in Poland. They have a similar form, but are somewhat less attractive in appearance. They have the denominations ½,1,2,5,10 and 20dkg (or dag),Fig 6.

In Germany, during the first world war, porcelain and zinc weights were used for trade because of the shortage of copper. These weights remained in use until the second world war. (Zinc weights were also made in Austria and in Hungary in 1918, and in all occupied countries during the second world war). The form of German porcelain weights is the same as the usual German iron ones, a flat cylinder without a knob, for the decimal values of 20,50,100 and 200g, and a narrow smooth high cylinder for the old-fashioned binary values of 125,250,500 and 1000g, Fig 1. Adjustment was done by means of lead shot in a central hole on top of the weight. The shot was covered by a lead disc which was stamped with the verification mark.

It is little known that directly after the war, glass weights were also made with the same high cylindrical form without a knob. The denominations of 1g up to 50g were moulded in relief on the top of the glass, Fig 4. Verification marks were etched on the sides. These glass weights were mainly used for pharmaceutical purposes. ▷

FIG 5. RUSSIAN WEIGHT

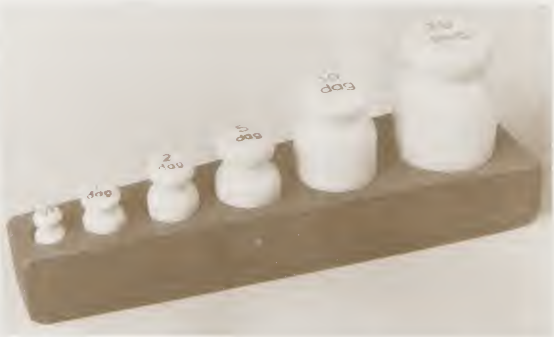


FIG 6. POLISH WEIGHTS

Russia was the sixth country where porcelain weights were made, and they were already in use in the 1930's. Just like the German ones, they were cylindrical without a knob, but otherwise there were several differences. The larger type of 100,200 and 500g were made of gray clay with a brown glaze, Fig 5. They were somewhat rounded on top. The stamps were impressed on the top. The small type, from 1g to 50g, were white, and the top was almost hemispherical, giving them a particularly handsome appearance. Verification marks were underneath. These small white glazed weights were mainly used by apothecaries.

This article was taken from a work first published in the Dutch Society magazine Meten & Wegen : 'Porcelainen Gewichten' by Dr. G.M.M.Houben.

Notes & Queries

NQ 55 THOMAS GABLE query from L.A.uit den Boogaard.

This week, I bought a very old English coin scale in a wooden box, containing an iron beam with brass pans, heavy green cords, and weights marked 3L 12s with crown, s21, s10 with crown, 13s 6d and F 1p with lily. The maker was Thos. Gable near Creechurch in Leadenhall Street, London. I cannot find it in Money Scales and Weights (by Sheppard & Musham), so if you have some information about the maker and the weights it will be welcome.

REPLY from the Editor.

Thomas Gable was made a freeman in 1739; and he was listed as a scalemaker in trade directories from 1750 to 1772. You will find details of the £3 12s series of weights for the Johannis in EQM p40. The 21s was for the guinea, the 10s for the light half-guinea (weighing 2dwt 14gn instead of the full 2dwt 16½gn), the 13s 6d is from the Moidore series 27s, 13s 6d, 6s 9d, from Portugal, and the last one was marked F 1p with a fleur-de-lys for the French pistole. All of these coins were circulating in England in the 18th century.

NQ 56 S.T.S. query from D.G.Matthews.

One of my English letter scales is marked with the maker's initials S.T.S. Do you know when this maker was operating ?

REPLY from the Editor

S.T.S. was the trade-mark of Samuel Turner, Senior, of Birmingham. He was listed as a brass founder and letter scale maker in trade directories from 1858 to 1920. You may be able to date your scale more precisely if it has postage rates, by consulting the 'GUIDE TO WEIGHING INSTRUMENTS' (ISASC publication available from Bob Stein).

Patently Interesting

See page 382, No.16.

O. C. WHITE.
EGG GRADER.
APPLICATION FILED DEC. 14, 1916.

1,259,181.

Patented Mar. 12, 1918.

Fig.1.

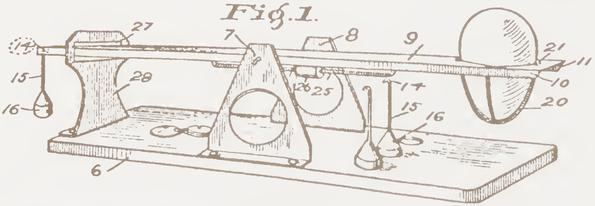


Fig.2.

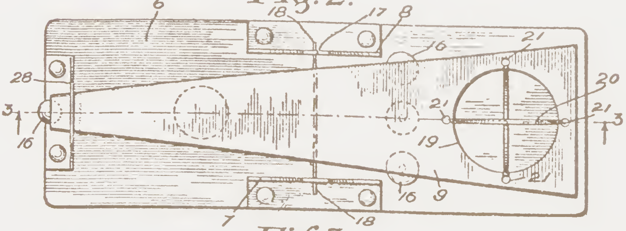


Fig.3.

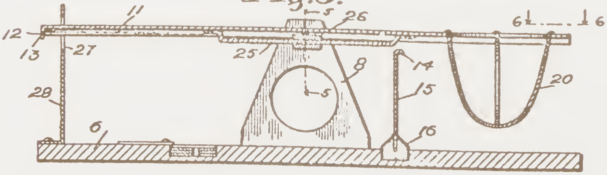


Fig.4.

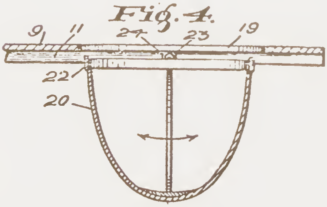


Fig.5.

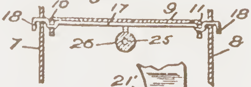


Fig.6.

INVENTOR
Oliver C. White

by Hazard & Miller
ATTYS.

The Troy Pound Mystery

TOM GRAHAM

When the Houses of Parliament in London were burned down in 1834, the impact on the ordinary people and traders was not particularly great. Nor, apparently, were Parliamentarians over-concerned by the knowledge that the fire had consumed not only the whole of the buildings, but also destroyed or damaged the Standard Weights and Measures so carefully legalised only ten years before. So, it was not until 1838 that the Astronomer Royal, G.B.Airy, and eight other men were appointed to report on the best means of determining new Standards.

The legalisation of the Standard Troy Pound in 1834 had been, itself, an extensively delayed procedure. Until then, there had been no single legally defined Standard Pound. Elizabeth I's 7000 grain Avoirdupois pound had run concurrently with the 5760 grain Troy pound, in an uneasy relationship, since 1588. Gradually, Avoirdupois weight became more important than Troy weight which, from Henry VIII's reign (1509-1547) had only been used for weighing precious metals, jewels, bread and drugs.

The transactions of the Royal Society, in 1743 and 1744, recorded that the standards were "..a pile of hollow brass weights from 256 ounces downwards to the 16th part of an ounce..." (i.e. Troy nesting weights down to 1.25 pennyweights, or 30 grains.). "The weight...is universally allowed to be the Troy weight...and as the Pound is...commonly mentioned in those Acts, 12 ounces taken from the pile of weights..., *as there is no single Troy pound weight,* must now be reputed to be the true Standard of the Troy pound..."

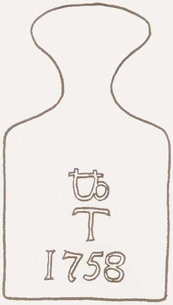
A Standard Pound based upon the addition of an eight ounce and four ounce weight was, presumably, abhorent, and in 1758 a committee of the House of Commons, under Lord Carysfort, recommended that a Troy Pound should be constructed to be the one true Standard from which the Avoirdupois Pound and all other weights should be derived.

Three prototype Troy Pounds were produced, by comparison with the other weights kept in the Exchequer, under the direction of Mr. Harris, Assay Master at the Mint. One of these three weights was put in the care of the Clerk of the House of Commons, and eventually, became the Imperial Standard Troy Pound.

In 1760, Lord Carysfort brought a bill before Parliament to legalise this pound, but the death of George II, the accession of George III, and the immediate dissolution of Parliament, caused the bill to be dropped.

Nothing further was done until 1818. In that year, a Commission was set-up to consider the establishment of a more uniform system of weights and measures. This Commission again recommended that the Standard should be the 1758 Troy Pound, with the 7000 grain Avoirdupois pound as a subsidiary. This passed into law in 1824. One section of the Act stated that if the Standard Pound was lost or destroyed it was to be restored by reference to the weight of a cubic inch of distilled water.[1]

In 1834, a careless stoker was burning some old Exchequer tallies[2] in the cellars of the House of Commons. His fire grew rapidly, got out of control, and soon the whole building was ablaze. Eventually, when it was possible to get in to the smouldering wreckage, the various standards kept in the Commons building were recovered, all except the recently legalised Troy Pound. Of course, the intense heat may have melted the small piece of metal (but the other standards did not melt), or it might have been overlooked, or it might have been picked up by some passer-by before any officials were on the scene. The other Standards, both of weight and length were discoloured, and the length Standards were bent and twisted. All of them were useless as criteria for new Standards, and so it became necessary to look elsewhere.



An impression of the missing Troy Pound. Dimensions believed to be $2^1/_2$ x $1^7/_{16}$ inches (64 x 36 mm). Drawing full size.

Following the exploratory work of the 1838 Commission, which proposed an *Avoirdupois* pound Standard, another Commission was formed, in 1843, to establish new Standards to replace those destroyed in the fire. Altogether, the Commission had eight Troy pounds to work with, weights which, at some time or other, had been compared with the missing Standard. Four were brass weights which, the Commission discovered, had increased in weight due to oxidation. Two were platinum, which appeared unchanged, and the other two were made at the same time as the Standard by Mr. Harris, in 1758. One of these weights, and a copy of it, were in the possession of Mr. Bingley, who was Master of the Mint and a successor to Mr. Harris. The other had been passed to Mr. Freeman, scalemaker to the Mint, but when he retired, the weight went to his successor, Mr. Richard Vandome, also a scalemaker (of the firm Vandome & Titford).

Mr. Bingley was asked to allow his pound to be used, but he refused because the Commission wished to boil the weight to remove air bubbles which might be retained by the surface irregularities. Mr. Vandome, however, agreed to his weight being boiled, so it was this weight that the Commission used to ascertain, as best it could, the original density of the lost pound.

Construction of the new Pound, which started in 1843, was a long and tedious affair. New balances of the greatest possible accuracy had to be constructed, and new, more accurate, thermometers and other instruments designed. Eventually, a figure for the assumed density of the missing Pound was derived. There was no authoritative record of the metal from which it had been made, except for one reference in a document by an observer, that it was of "fine copper". The only other records were by Captain von Nehus whose measurements had been made with relatively inaccurate 'bowlegged calipers'. His drawings could not be found, though, apparently, the measurements were available. The metal of Bingley's and Vandome's weights was thought to be brass or gunmetal.[3] One suggestion was made that a large piece be cut from one of these weights and weighed in air and water, but it was not tried.

In effect, the very learned scientists employed, had to begin their extremely important task with a somewhat pious hope that they made the right guess. One might not blame them if they decided that (as they were making something entirely new - not a Troy Pound, but an Avoirdupois Pound) it didn't make much difference if they produced a weight a fraction of a grain lighter or heavier than it should be.

W.H.Miller, Professor of Mineralogy at Cambridge University, who was in charge of the operation, first made a Troy pound of platinum, representing as near as possible, the weight of the old Pound, in air. He then prepared a series of auxiliary weights, also in platinum, which could be compared for accuracy, the larger ones with combinations of the smaller ones.[4] They were denominated as follows:- four of 1240 grains each; one of 800; one of 440; one of 360; four of 80, and two of 40 grains each. Then, finally, he made the Avoirdupois Pounds, of 7000 grains, by adding a weight of 1240 grains to the Troy Pound. Five platinum Avoirdupois Pounds were prepared by Professor Miller and were marked, for the Parliamentary Standard 'PS 1844 1 lb' and the four Parliamentary Copies were marked 'PC No 1 1844 1 lb', and similarly for numbers 2,3 and 4.

The purpose of making four copies of the new Pound was to provide for simpler restoration in the event of its loss or damage. In that event, one or other of the copies could be adopted or a new Pound made, by reference to them. To avoid a repeat of the 1834 disaster, these Copies were all kept in different buildings at a considerable distance from each other.

The Commission reported in 1854, presenting the new Standards for acceptance by Parliament. They were approved and authorised by the Act of 1855, which also put the Avoirdupois Pound on the Statute Book as being "...*the only Standard of Weight from which all other weights and measures having reference to weight shall be derived...and one equal Seven Thousandth part of such Pound Avoirdupois shall be a grain and Five Thousand Seven Hundred and Sixty such Grains shall be a Pound Troy."*

This last provision was somewhat surprising, for all the earlier official recommendations had been that the Troy Pound should be abolished. This was not done until the Act of 1878 took out references to the Troy Pound to avoid confusion, and made the Troy ounce, of 480 grains, a primary standard for weighing precious metals and stones.

It may seem to have been a long time, from 1843 to 1854, to create the new Standard, but the Commission was also working on the creation of a large number of new secondary standards, comparing them with each other, and comparing them with the French Standard Kilogram. It is possible that they could have proceeded with greater speed and more confidence in re-establishing the Pound if ALL the existing weights had been made available. The fact that they were not, is a mystery.

Bingley had two weights, one allegedly a copy of the prototype made by Harris. Richard Vandome also had a copy of his prototype. All these weights were of very similar dimensions and shape, and all were marked 'lb T 1758'. On one of Bingley's the vertical stroke of the 5 in 1758 had been put in by a chisel. The same peculiarity applied to one of Vandome's, which was also marked SF, the initials of Samuel Freeman, Vandome's predecessor. Nowhere in the report by Professor Miller is there any mention of Vandome's second weight and Vandome did not give evidence to the 1838 Commission, or at least, was not called upon to do so. When Vandome & Hart were celebrating their tercentenary, in 1960, a reference was found to this second weight being used for the production of a set of Troy Standards for the Jamaican Government, in 1758. Why hadn't Richard Vandome told the Commission he had a second weight ?

Again, surprisingly, after the Avoirdupois Pound was legalised, Professor Miller wrote that he had learned that the Bank of England had a weight like Vandome's and Bingley's, also with the vertical stroke of the 5 missing. Why wasn't that weight brought to the Commission ?

It has always seemed strange to me that of all the Standards in the House of Commons, only the Troy Pound was missing after the fire of 1834. Had Bingley of the Mint perhaps secretly borrowed it to compare with his copy (one can imagine how difficult it would be to obtain it officially) - and then become afraid to reveal his collusion with some officer of the Commons, when the fire occured? Why, when he was giving evidence to the 1838 Commission, did he refer only to one weight which, he said, had belonged to his Father? And why did Vandome not mention his other weight?

The question still remains, nearly a hundred and fifty years later, what did happen to that missing Pound, in 1834? Was it utterly destroyed by the fire, and does it now lie buried in an undistinguished foundation of some London building ....or, might we ask, have YOU got it ?

FOOTNOTES

1. *This basic volume had been researched, first in 1797 by Sir George Shuckburgh, and confirmed in 1821 by Captain Kater, as being determined by weighing in air, against brass weights, at the temperature of 62°F and a barometer reading of 30 inches, and declared to be equal to 252.458 grains. It was subsequently discovered that any new Pound produced from this basis would be 2.829 grains too heavy.*

2. *Tallies were lengths of wood, split down their length, the two edges put together and notched when a payment was made. One half was kept by the debtor, the other by the Exchequer.*

3. *Gunmetal is a particularly hard wearing alloy of copper and zinc; one of the family of brasses.*

4. *The explanation of how the new Pound was created from these weights, combined with the 5760 grain Pound, was given in the report to Parliament, in 1854 :-*

   "Expressing the error in the 40 grain weight by an algebraical symbol, the error of every weight in this series is determined from comparisons of the weights and is expressed in two terms, of which one is numerical, and the other is a multiple of that symbol; and the error of 4 x 1240 plus 800 is also expressible by a numerical term and a different multiple of the same symbol. These being compared with the Troy pound of 5760 grains, the value of the symbol was obtained, and therefore, the error of any of the 1240 grain weights was known; and then a pound of 7000 grains was formed by adding the Troy pound and a weight of 1240 grains." ➢

In the Parliamentary report, Professor Miller did not explain what the error in the 40 grain weight was, so it is evident that Parliament took his word for it! In his later Transactions report, the paragraph on this point is immensely confusing.

It is worth noting that some of the auxiliary platinum weights were found to be exuding a deliquescent substance (one which attracts moisture from the air). This unwelcome property was found to have affected all the earlier weighings in the making of the Standard, with the result that when this substance was at last removed, all the weighings had to be repeated.

Tom Graham is the author of two excellent booklets on Scales and Weights; see REVIEW in EQM pp 226 & 355.

A Weighty Problem

A man had eight coins and, although they looked identical, one of them was not the correct weight. He didn't know whether the incorrect coin was light, or heavy. Unfortunately, he had forgotten his weights, but he had his scales. So, with some careful thought, he was able to determine which coin was false and in which way the error lay, light or heavy. It took him no more than three weighings - how did he do it ?

If you get stuck, read the hint below.

HINT: Number the coins 1 to 8.

Hulls and Bradford were earlier!

Coin scale enthusiasts please note that there is a typing error on page 268. The date of the Hulls and Bradford patent was 1753 (not 1773).

About Postal Patents

MICHAEL CRAWFORTH

A SURVEY OF POSTAL SCALES PATENTED IN BRITAIN, 1840 TO 1940.

Many unusual and fascinating ideas for postal scales were recorded in patent documents. They were often ideas devised by people outside the scale industry who felt themselves capable of designing weighing instruments for letters and parcels. Ignorance of engineering requirements sometimes led to bizarre and impractical ideas which had little chance of success, ideas which probably never came to fruition as manufactured scales, or even as prototypes. Other patents were thoroughly down-to-earth practical solutions to the problems of speed, convenience, accuracy and cost. Such scales were made, often in large quantities, and some survive today in homes, museums and private collections.

Tracing patents is a fascinating pastime. It provides an approximate period for manufacture, the name of the patentee/inventor, occasionally the name of the manufacturer, and, most interesting of all, an insight into the thinking and intentions of the designer.

This survey shows that the most popular idea among inventors of postal scales was the pendulum resistant, and many variations on this principle were patented. Although there had been earlier applications of the pendulum for weighing, they had been relatively few and obscure. So, in the mid-nineteenth century, the idea seemed novel and exciting, and well able to compete with the self-indicating properties of spring balances. Next in popularity were the table-top steelyards mounted on a base, followed closely by spring balances and bismars which were equally popular with patentees.

Of course, all these types were heavily out-numbered by the many Roberval scales which were manufactured, but the Roberval design, as such, did not offer much scope for patentable variations. It was the half-Roberval system combined with various resistants, which inventors found more useful, because the letter plate, being supported above the beam, was convenient for weighing letters or parcels of various sizes and shapes. Thus there were patents for half-Robervals combined with steelyards, springs, pendulums and weight-lifting beams.

It was an age of great inventiveness and ingenuity when almost anyone could become an entrepeneur. Above all, the sixty-year period from 1870, was the age of the weighing compendium. The letter balance was combined with all sorts of useful tools or gadgets. They were combined with call-bells, pencils, pens, inkstands, penknives, paper knives, stamp containers, clocks, rules, tape measures and even a walking stick. Many combined two or three of these tools in one instrument.

Perhaps the most remarkable aspect revealed by this survey is the repetition of virtually identical ideas. There were ten patents for letter scales combined with pen or pencil holders, five combined with penknives or paper knives, seven for weight-lifting beams, and many of the pendulums appear to have only minor differences. Thus, it is necessary to read the patent in detail to determine exactly what was being patented. In many cases, it was a very small part of the instrument which was novel, and only that part was the subject of the patent. A casual glance at Staudenmaier's patent of 1906 might lead the observer to conclude that the half-Roberval and pendulum balance on a tripod base was the subject of the patent, and that it was first thought of in 1906. In fact, Staudenmaier's idea was to limit the amount of swing, or 'vibration' of the instrument by small pins inserted in the quadrant to speed the process of weighing. The basic design of this balance, without pins, had been in production in Germany for at least two decades, and had been imported into England for at least nine years, when Staudenmaier's patent was granted.

Similarly, Wight's patent of 1870 shows a candlestick type of spring balance, but this was not the subject of the patent. Wight's idea was merely to include a candlestick balance in an elaborate inkstand which covered all the writer's possible needs. The candlestick balance had been thought of thirty years before when Winfield registered the design in 1840.

When Thaddeus Fairbanks of America, took out his British patent of 1859, he was not patenting the idea of a postal steelyard for desk use. His idea was the application of an already established method for stabilizing the pan with a weight, to a postal steelyard.

There are many similar examples, so patent dates must be treated with care. They are useful for establishing the earliest date for the manufacture of a particular scale on which the patent is mentioned, or which can be identified as identical to the patent description. However, it cannot be assumed that it is also the earliest date for that general type of scale. This can only be determined by studying the patent in detail.

The following survey covers over 80 British patents for postal scales, from 1840 to 1940, and will be spread over several issues of EQM. Notes, comments and illustrations are provided to assist in identification, dating and to describe the essential features being patented.

NOTES

1. Several patents did not include drawings, so the reader is left to interpret a written description as best he can. Although many patentees specifically mentioned the use of their scale for postal purposes, others worded their patent so that it could have the widest possible application and did not mention any specific purpose. Some of the latter have been included in the survey if they are known by the author to have been made for postal use, or if they were patented by persons known to have been connected with postal scale manufacture, or if the drawing clearly suggests that postal purposes were in the mind of the patentee.

2. The British patent system started in 1560 and 'letters patent' (i.e. a letter of authority from the Monarch open to public inspection) were numbered consecutively from 1617 up to 1853. From 1854 to 1914, the numbers were restarted at No 1 at the beginning of each year, so items patented during

this period were marked with the number AND the year of the patent. In 1915, consecutive numbering recommenced, so it may not be immediately apparent if a patent number came from 1915 or from the period 1617 to 1853. More patents were issued in the one year, 1915 (100,000), than in all the years before 1854 put together (14,355).

3. The drawings used to illustrate the survey are taken from the original patents, but letters used to annotate the various parts have been removed for clarity. Although there were often several drawings with each patent, space permits the inclusion of only one key drawing per patent. Readers wishing to obtain xerox copies of a complete patent are advised to write, giving the number, year and patentee's name, to Leeds Commercial & Technical Library, Leeds LS1 3AB, England. (Their service is quicker than the Patent Office).

POSTAL PATENTS - ANALYSIS (1840 - 1940)

TYPE OF SCALE		No. OF PATENTS	
Pendulum		19	(22)
Steelyard		16	(19)
Spring		13	(17)
Bismar		13	
Half-Roberval		11	(15)
Weight-lifting beam		7	
Unequal-arm beam		5	
Rocker		2	
Hydrostatic		1	(3)
Mass-stabilsed pan		1	
Compendium		23	
Combination with	pen or pencil	10	
	penknife, paper knife	5	
	inkstand	4	
	rule	2	
	call bell	1	
	stamp container	1	
	clock	1	
	tape measure	1	
	walking stick	1	
Decoration applied to letter scales		1	

Figures in brackets include patents which do not specifically mention postal purposes, but which are known to have been made for this purpose.

Patent Postals

MICHAEL CRAWFORTH

A SURVEY OF POSTAL SCALES PATENTED IN BRITAIN, 1840 TO 1940.

1840 14 Jan. No. 8342. C.E.DAMPIER. See Fig 2.

A circular plate acts as a bent lever, or pendulum beam, and carries "geometric" graduations and subdivisions. Various modifications are described. Applied to pendulum letter balance and other weighing instruments.

Dampier remarks that "In the ordinary scale a multiplicity of weights are used, whilst in the 'Geometric Balance' one weight only is required..." "The principle upon which the Geometric Balance is constructed, being purely mathematical, renders it equally applicable to weighing the smallest particles, as well as the most bulky packages,...with undeviating accuracy; it is also free from those objections to which instruments acting by a spring, or other internal machinery, are always liable by change of temperature and continual use."

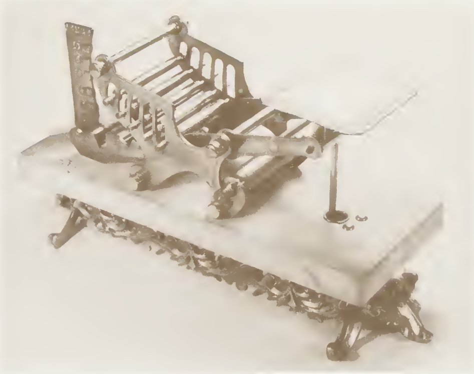
A contemporary discussion of Dampier's new balance, in the Mechanic's Magazine, comments - "The article is certainly very handsomely got up, and answers for all common purposes exceedingly well, though, we must confess, the "Geometry" of the thing rather eludes our search. Neither do we see that anything is gained, in point of accuracy, by the substitution of the circular plate for a staight lever and quadrant, though doubtless it may be thereby rendered a much more ornamental article of furniture..."

A subsequent issue of the magazine contained the following reply from Dampier, "...you infer that the various graduations of weight are made by the mere mechanical operation of suspending a succession of weights and marking off the distances... a process which, if the graduations were very numerous, would not only be most tedious but likewise very uncertain. This, however, is not the case in the construction of the 'Geometric Balance' the various graduations of which are found by means of a strictly geometric figure, according to the angle of the bent lever upon which the machine is constructed" "..you will also observe my application of the circular plate, as a substantial equipoised balance beam, and not producing by the change of its position any counteraction upon the graduated scale which the quadrant or any other irregular figure must effect in every change of its position, by its own gravity and variation in leverage."

Dampier was an attorney by profession, so it seems unlikely that he made the letter scale. They were sold by an agent, R.T.Hughes and later J.G.Hughes, both of 158 Strand, London.

1840 12 Feb. No. 8384. R.WILLIS See Fig 1.

A method of constructing a weigh beam so that weights are successively taken up in such a manner that each weight is held without swinging or moving with respect to the beam. Applied to a letter scale with half-Roberval support for the letter plate.



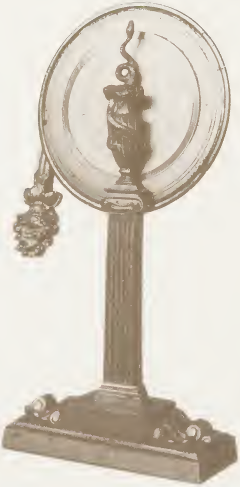


FIG 1. Weight-lifting beam scale made to Willis' patent by J & E Ratcliff.

FIG 2. (right) 'Geometric' scale made to the patent of Dampier. Letter holder missing.

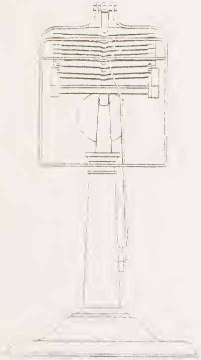
Robert Willis, who was Jacksonian Professor at Cambridge University, was careful to state in his patent:- "I do not claim the principle of causing the scale beam or suspended frame of a balance to raise weights in succession, various contrivances for that purpose having been used before..." His letter balance was designed to indicate the postage rapidly, moving to the appropriate value directly without balancing in between graduation marks. To assist this function he gave the following instructions:- "The packet should be placed gently on the scale to reduce the oscillations which are inseperable from a well constructed weighing machine; or the balance may be held down.... and gradually relieved after the letter is deposited, which will entirely prevent the vibrations, and prove the most rapid way of employing the instrument". The capacity could be increased by placing an auxiliary weight in slots at the end of the twin beams. Postage rates were indicated on a graduated arc fixed to the base. No weight values were shown.

The prototype appears to have been made by Holtzapffel & Co, but manufacture was carried out by Joseph and Edmund Ratcliff of Birmingham.

1840 10 Sep. No. 8622. MARK FREEMAN. See Fig 3.

A form of bismar with ten alternative pivots which are automatically tried, in succession, until the load is balanced. Applied to a letter balance mounted on a pedestal base.

This is a most interesting and unusual concept which provides a bismar with self-indicating facilities. It also uses proper knife edges, unlike its rival the pendulum balance, which suffers from extra friction from spindle type



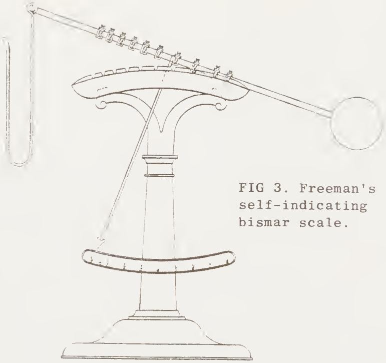


FIG 3. Freeman's self-indicating bismar scale.

bearings. Alignment of all the knife edges with the notches must have been a production problem. No example has been seen by the author.

1854 28 Oct. No. 2298. JEAN.P.SAVOURÉ. See Fig 4.

An unequal-arm balance which weighs coins placed in slots in the long arm, or letters placed in a rack suspended from the short arm (with the addition of a sliding weight).

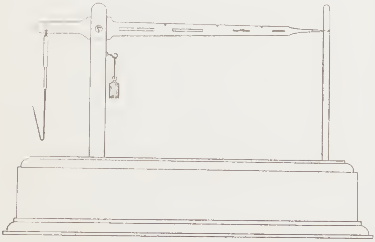


FIG 4. Savoure's combined letter and coin scale.

Unlike most coin balances with slot gauges, Savouré's instrument had slots in a vertical surface. This permitted full gauging of the coin size while retaining the coin for weighing. The principle was an unequal-arm rocker. When weighing letters, a letter rack was suspended from the short arm and a sliding weight was suspended from the long arm. Thus, the instrument was converted to a conventional steelyard, with the weight adjustable in the normal way to balance the letter.

THE SURVEY WILL BE CONTINUED IN FUTURE ISSUES OF EQUILIBRIUM